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DEDICATION TO DR. ANDRE LAURIN

Dr. Andre Laurin was one of the founding members of the Committee of Provincial Geologists, and did much during the early formative years to strengthen coordination, and standardization of Geological Survey activities across Canada.

Throughout his term of office with the Committee, Andre demonstrated leadership and insight that benefitted not only his own province of Quebec, but also many other regions where Survey organizations were attempting to keep pace with rapidly changing technological and political realities, at the same time as mounting the ongoing documentation of their mineral resources. In the mid-seventies, with Andre's support, Quebec and Manitoba became two of the first provinces to standardize the guidelines for submission of industry exploration reports.

During his career Andre worked hard to develop policies and initiatives that would facilitate mineral development in Quebec, and to ensure that Survey programs were targetted in regions that would benefit industry the most. This vision continued in later years when he relinquished his leadership role with the Provincial Government to join SOQUEM, as President and Chief Executive Officer.

Always a champion of the provincial organizations, Andre nevertheless maintained a constant dialogue with his federal counterparts, and did much to ensure that GSC initiatives in the province of Quebec complemented those of the provincial Survey.

The Committee of Provincial Geologists wishes to dedicate the 1991 volume of the Provincial Geologist's Journal to Andre Laurin in recognition of his resolute support for the committee's activities, and in memory of his sincere, humorous, witty, and always bouyant contributions to the debates he took part in, and the causes he championed so effectively.

FOREWORD

I would like to take this opportunity to thank everyone involved in the compilation of Volume 9 of the Provincial Geologists Journal. This Journal represents a group effort that requires the co-operation, dedication, and support of every provincial and territorial organization in the country.

A special acknowledgment should go to the following individuals who compiled and edited major portions of the document. They include: Ron Smyth and Claudia Logan, British Columbia Ministry of Energy, Mines and Petroleum Resources; Dave McRitchie, Manitoba Department of Mines and Energy; Vic Milne, Mike Grant, Alison Weatherston and Kerstin Lindgreen, Ontario Ministry of Northern Development and Mines; Robert Lamarche and Denis Lefebvre, Quebec Ministere de l'Energie et des Ressources; and Danny Murray, Nova Scotia Department of Mines and Energy.

As in 1990, the Alberta Geological Survey was responsible for final editing and compilation of the Journal. Special thanks should be extended to Mike Prentice and his team of Denise Boisvert, Dale Hite and Karen Parrish-Hite for another job well done.

The Provincial Geologists Journal is available in each province and territory through the offices of the respective geological surveys listed on the back cover of the Journal.

Rand Harrison
Head
Alberta Geological Survey
Alberta Research Council

THE COMMITTEE OF PROVINCIAL GEOLOGISTS
Chairman's Report, 1991

As in previous years the Committee has met twice in 1991. The first of these meetings, at the Prospectors and Developers Association of Canada, Annual Meeting, March 24, 1991, provided an excellent forum for discussion of geoscience, and rnineral resource and development issues with representatives of the mineral exploration industry.

This meeting also provides an opportunity for focussed information transfer and promotion to a major client group of the provincial surveys. Recent geoscientific work of the provinces and territories was displayed for three days in the Provincial room at the convention. The Committee also published Volume 8 of the Provincial Geologists Journal, which was released at the March meeting. The Journal provides information on highlights of the provincial programs, organizational structures, budgets and program outputs, and reports on the work of the committee. In addition, the convention once again featured a Provincial day in which a half day of the sessions was dedicated to the presentation of papers by provincial staff. These papers provided reviews of the provincial exploration scene or highlighted interesting exploration or development opportunities which a province wished to promote. The papers selected by the committee for the "Provincial Activities" session were:

- The Ontario Bureau of Mines: A 100-Year Prospect – Hon. G. Pouliot, V.G. Milne
- Financial Assistance to Prospecting: Quebec's Recent Experience – Jean-Pierre Lalonde
- Mt. Milligan Success Highlights Alkaline Suite Porphyry Deposits: B.C.'s New Gold-Copper Giants – V.A. Preto and J.L. Nelson
- A Possible Genetic Link Between Carboniferous Tectonics and Metallic Mineral Occurrences in Nova Scotia – R.J. Ryan and R.C. Boehner
- Rare Metals and Rare Earths in Labrador – R. Miller
- A New Base Metal Discovery in the Siluro-Devonian Tobique Belt of New Brunswick – R.A. Wilson

The second meeting of the Committee, on September 22, 1991, immediately preceded the Mines Ministers Conference in Halifax. A major objective of the Provincial Geologists is the development and maintenance of coordination between the provinces and the Geological Survey of Canada, to maximize the synergy of geoscientific programs, target limited program resources efficiently, and to minimize duplication of effort across the country.

Considerable strides have been made in the two years since the Committee recommended in its 1989 brief to the Mines Ministers, that formal mechanisms be established to promote coordinated planning and cooperative operation between the provincial and federal surveys. Memoranda of Understanding, formalizing program planning coordination are in place or in development with most provinces. The integration and complementary aspects of the new round of mineral development agreements has benefited significantly from extensive co-planning and an enhanced collaborative spirit. Concurrently, and facilitated by these formal programs, NATMAP projects involving interprovincial and federal participation are being developed.

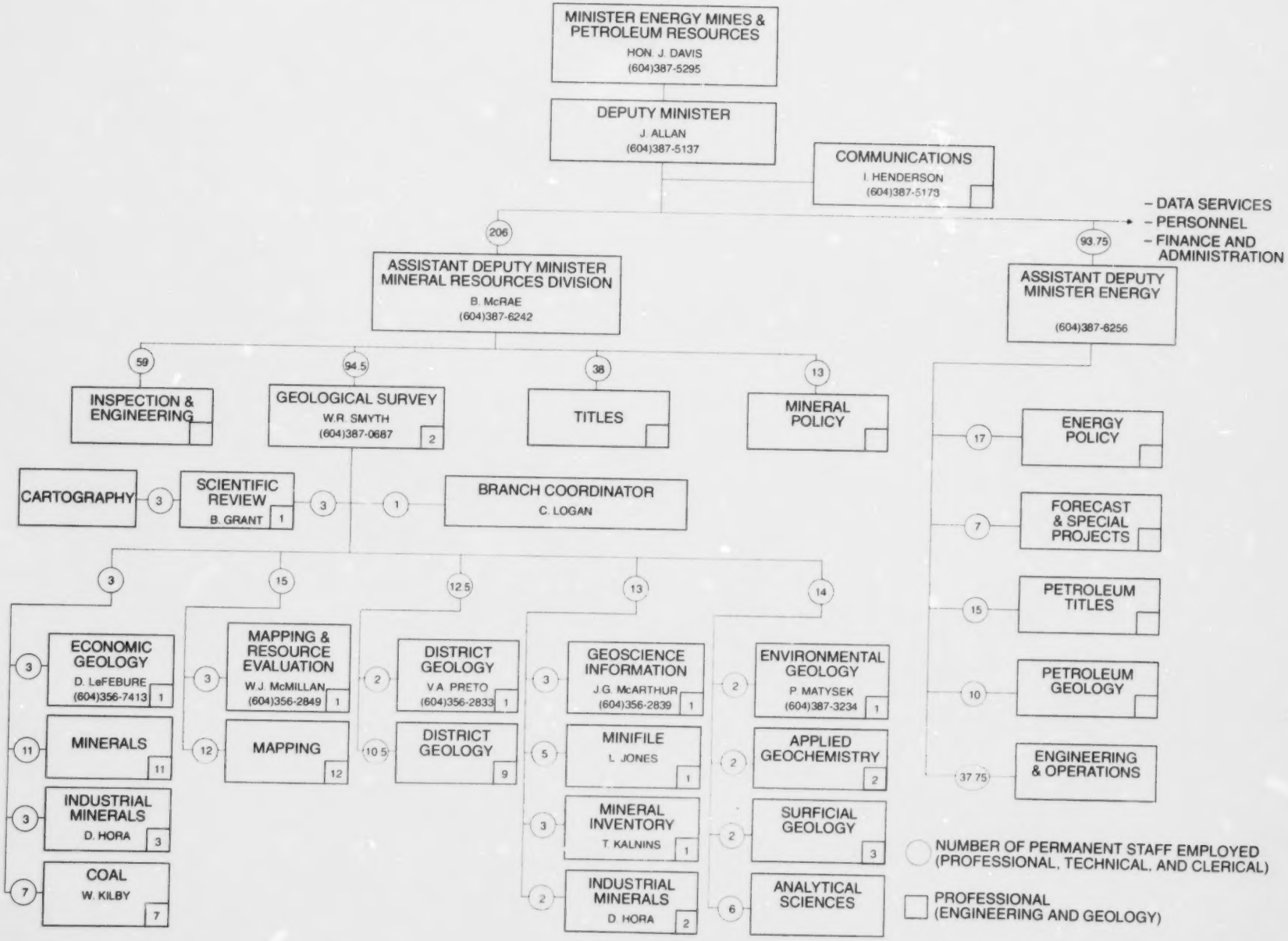
The provincial surveys also continue to liaise with the Geological Survey of Canada through the National Geological Survey Committee and in 1991 a federal-provincial task group formed by the Committee completed a "Guide to Aeromagnetic Specifications and Contracts" report.

The Committee of Provincial Geologists was formallly established by the Mines Ministers in 1976, and the present Committee owes a deep debt of gratitude to the original members, for establishing credibility and setting a sound course for the group by their dedication and hard work. The Committee was saddened by the loss early this year of Dr. Andre F. Laurin, a spirited, intelligent and very amiable man, who as a founding member, spearheaded many of the Committee's early initiatives and continued as an active mentor and friend until his death.

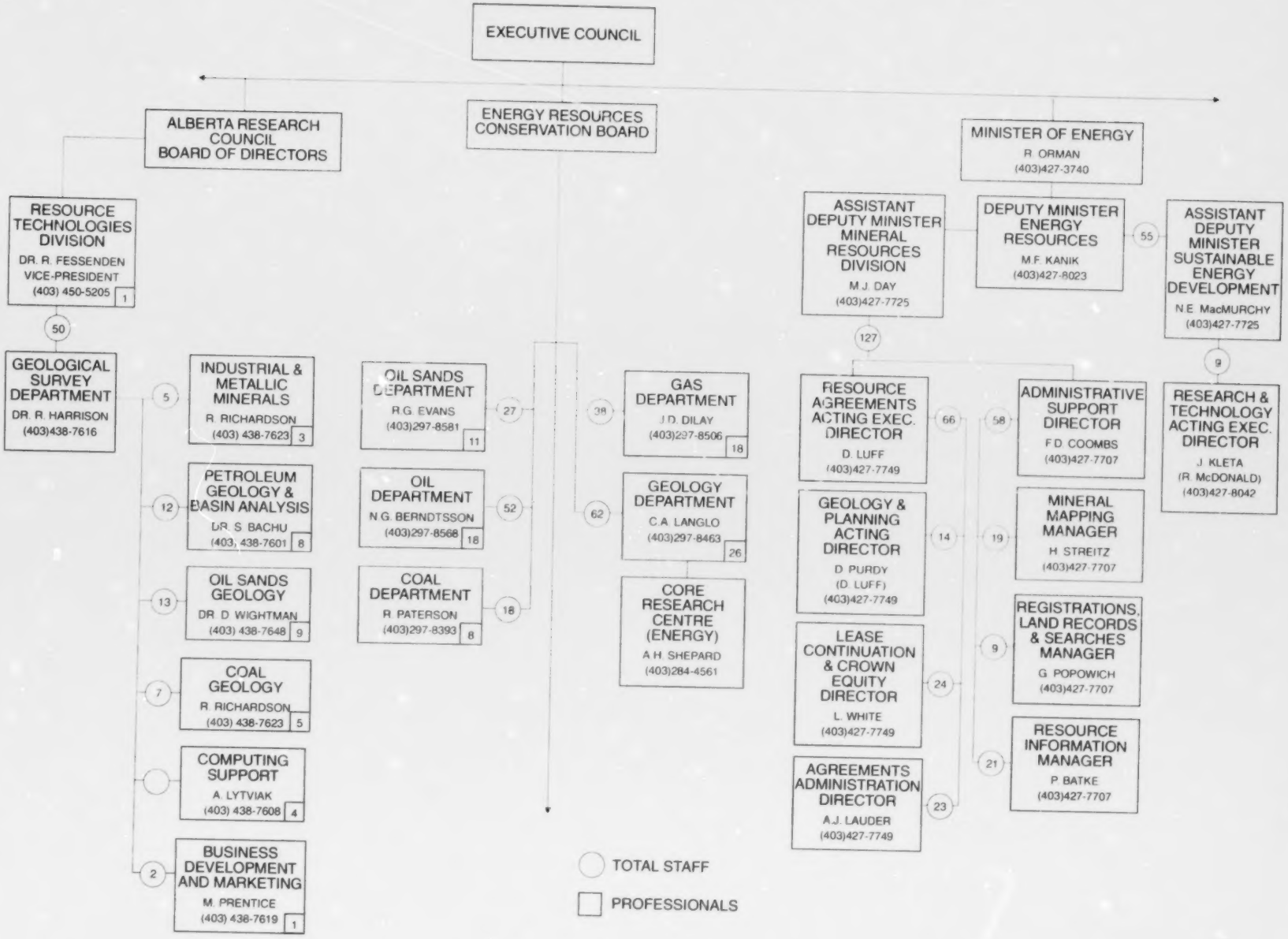
GEOSCIENCE ORGANIZATION CHARTS

Each provincial and territorial government in Canada has developed its own organization structure for conducting geoscientific survey and research work. Some provinces have what is formally called a Geological Survey (e.g. Ontario Geological Survey), but in most jurisdictions the main elements of the geological survey function are embraced in one or more Branches or Divisions of provincial Mines/ Energy/Natural Resources Departments (e.g. the British Columbia Ministry of Energy, Mines and Petroleum Resources is divided into a Mineral Resources Division and a Petroleum Resources Division, with the bulk of geological survey and research work conducted in the Geological Branch of the Mineral Resources Division). The following organization charts are set out in standard format to help alleviate confusion amongst potential users of provincial geoscience services. The charts contain reference to the lines of reporting of the various units in each hierarchy, the manpower associated with each separate jurisdiction, and the names and telephone numbers of key individuals in each system.

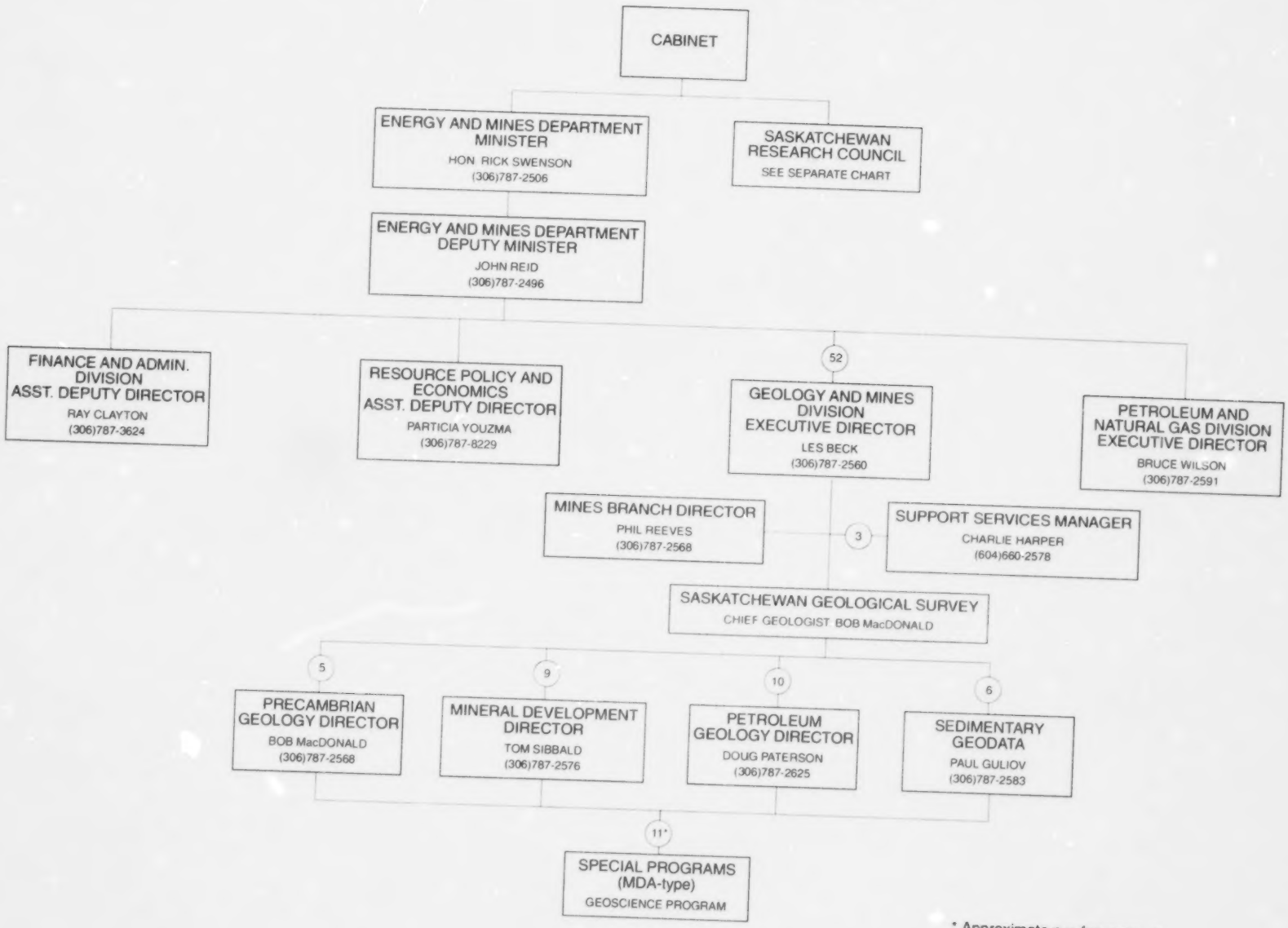
BRITISH COLUMBIA GEOSCIENCE ORGANIZATION CHART



ALBERTA GEOSCIENCE ORGANIZATION CHART

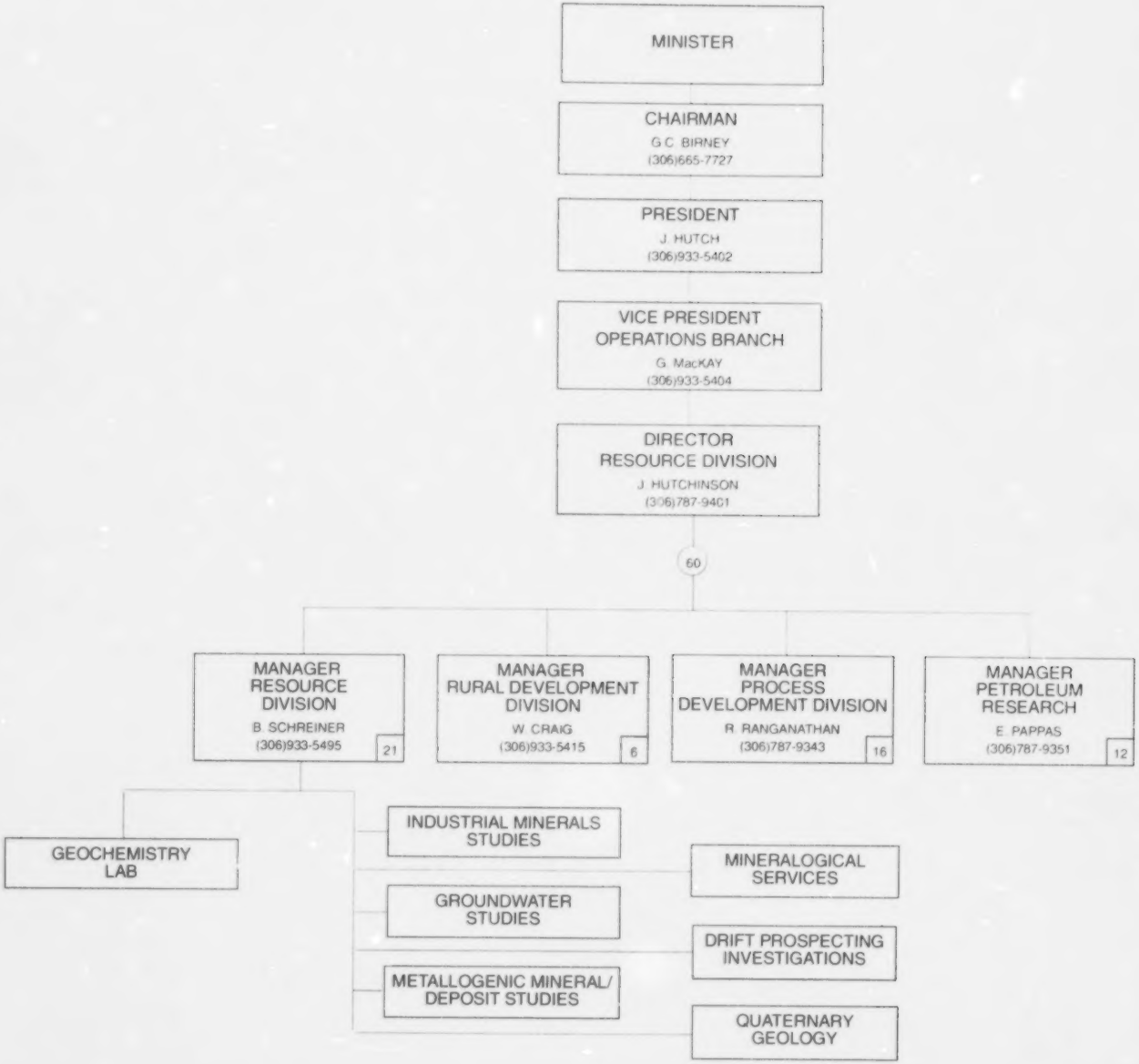


SASKATCHEWAN GEOSCIENCE ORGANIZATION CHART

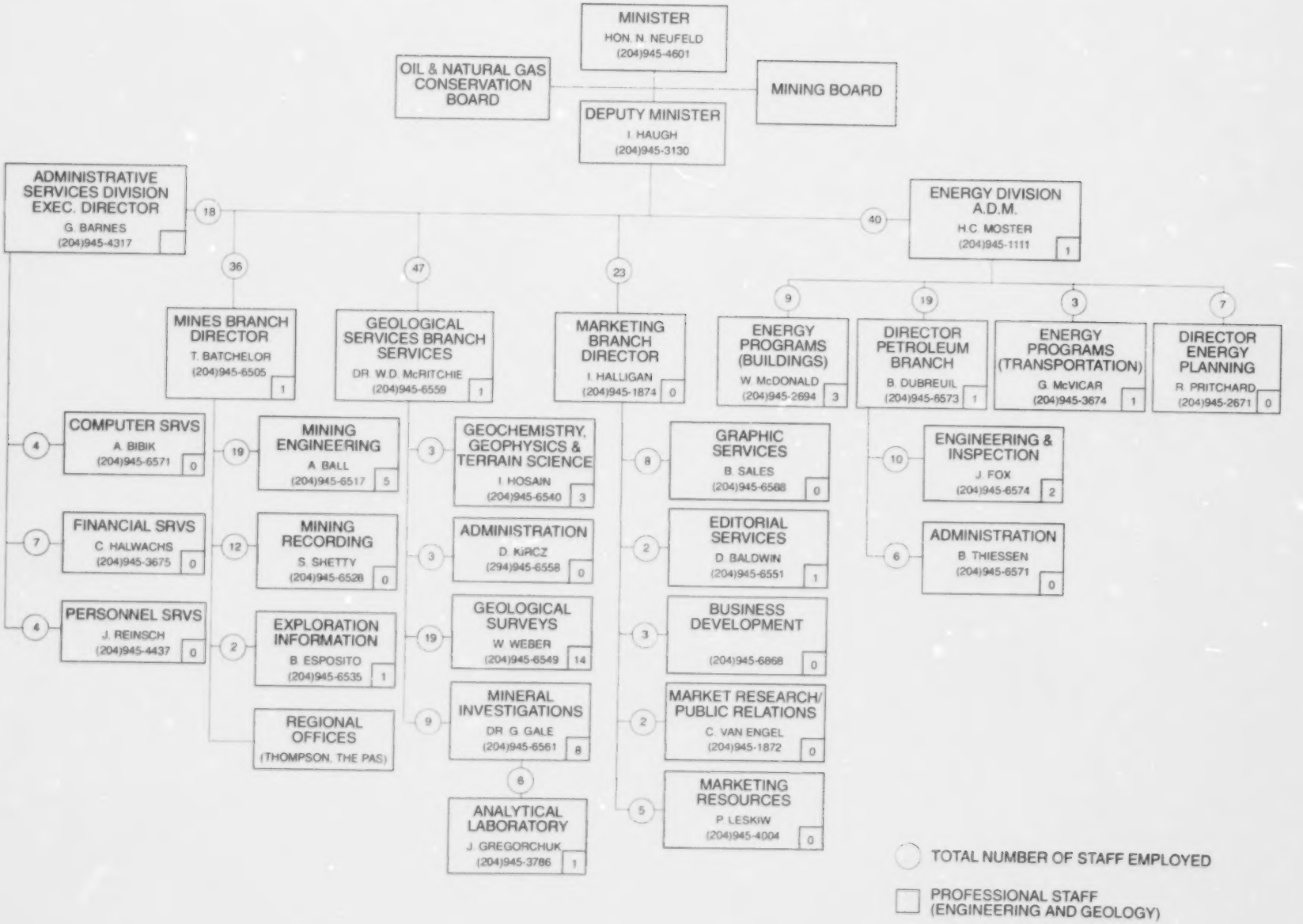


* Approximate p.y. for contract geologists (6) and summer student assistants (5)

SASKATCHEWAN RESEARCH COUNCIL
Geoscience Services

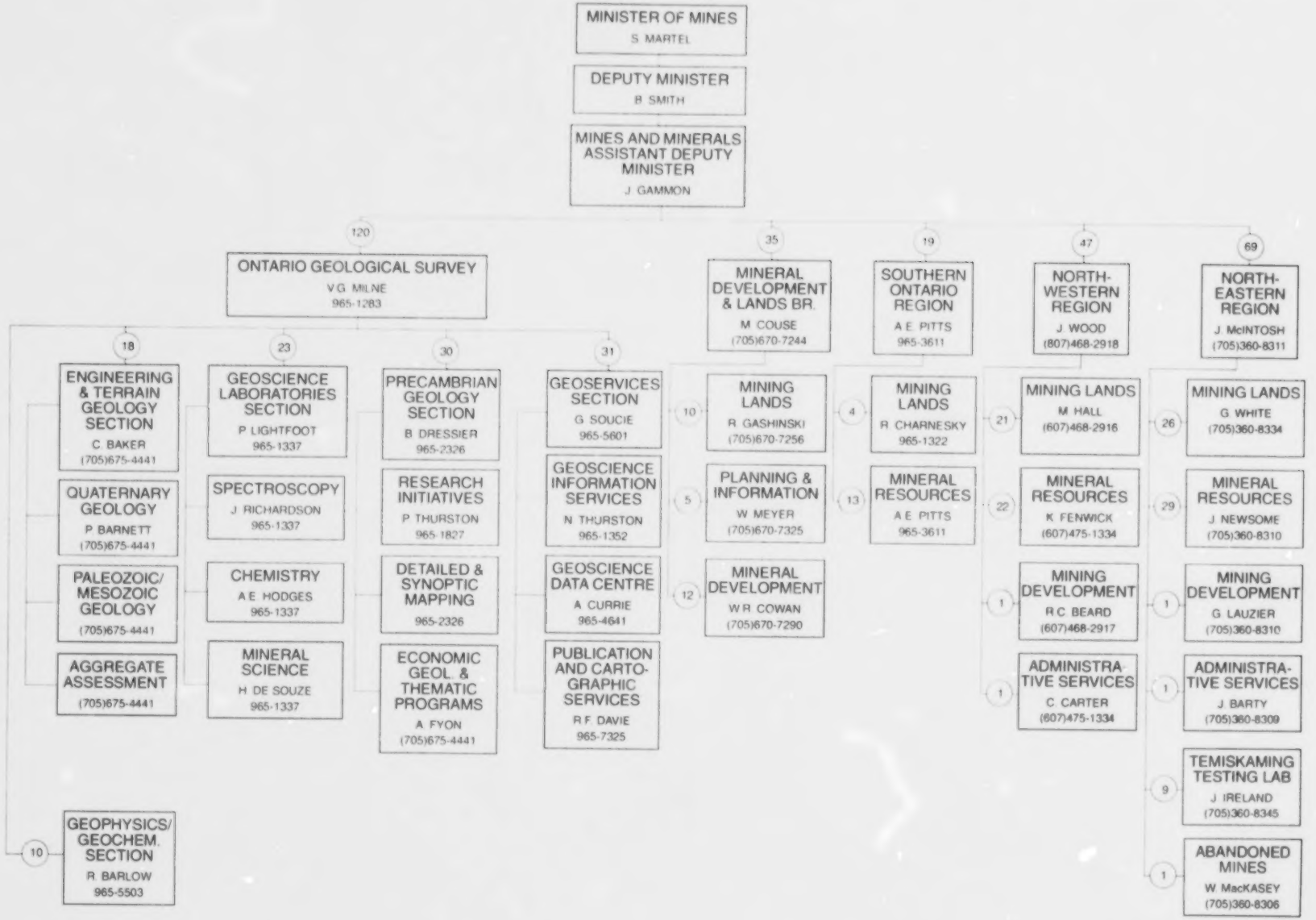


MANITOBA GEOSCIENCE ORGANIZATION CHART

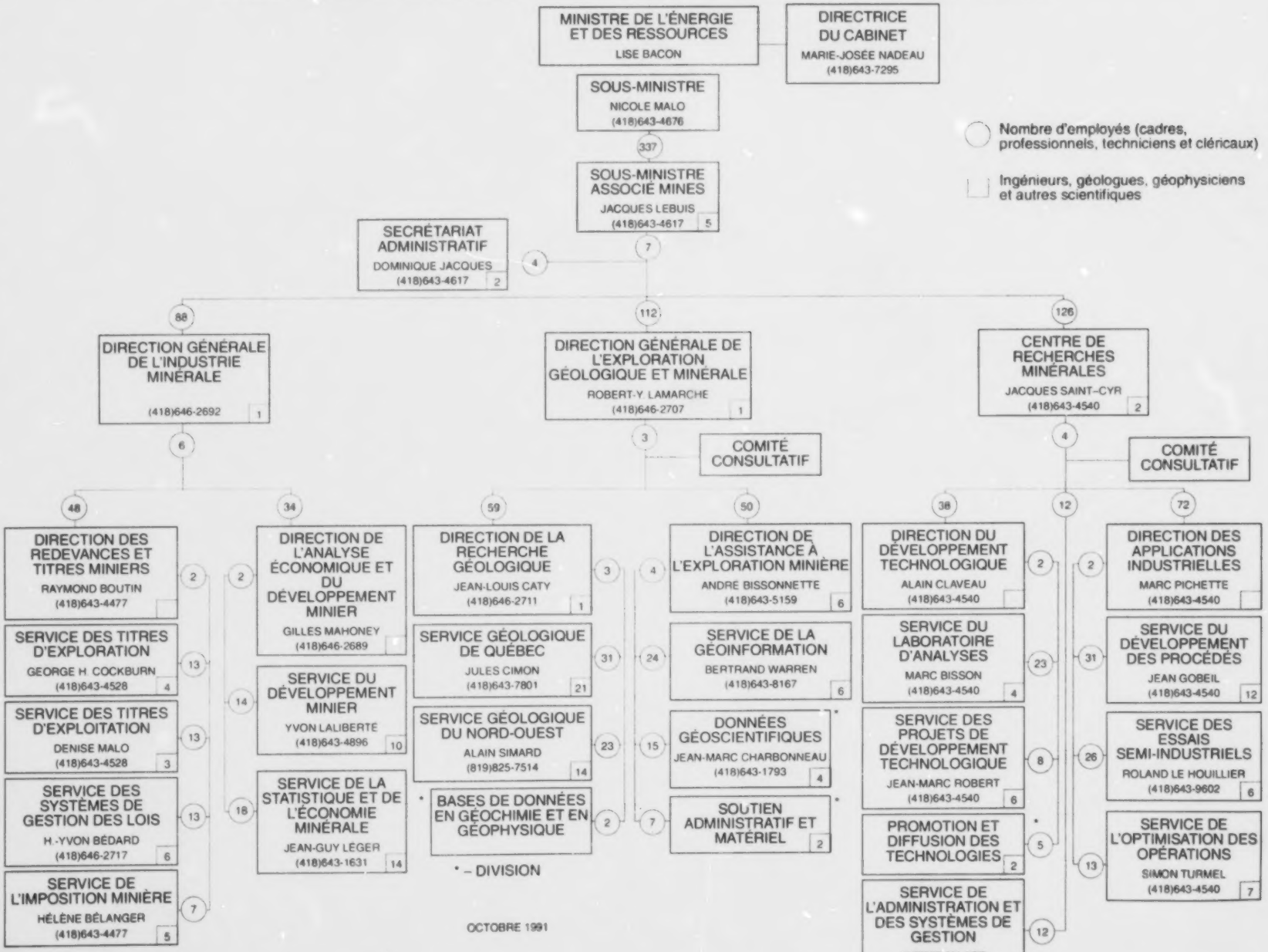


ONTARIO GEOSCIENCE ORGANIZATION CHART

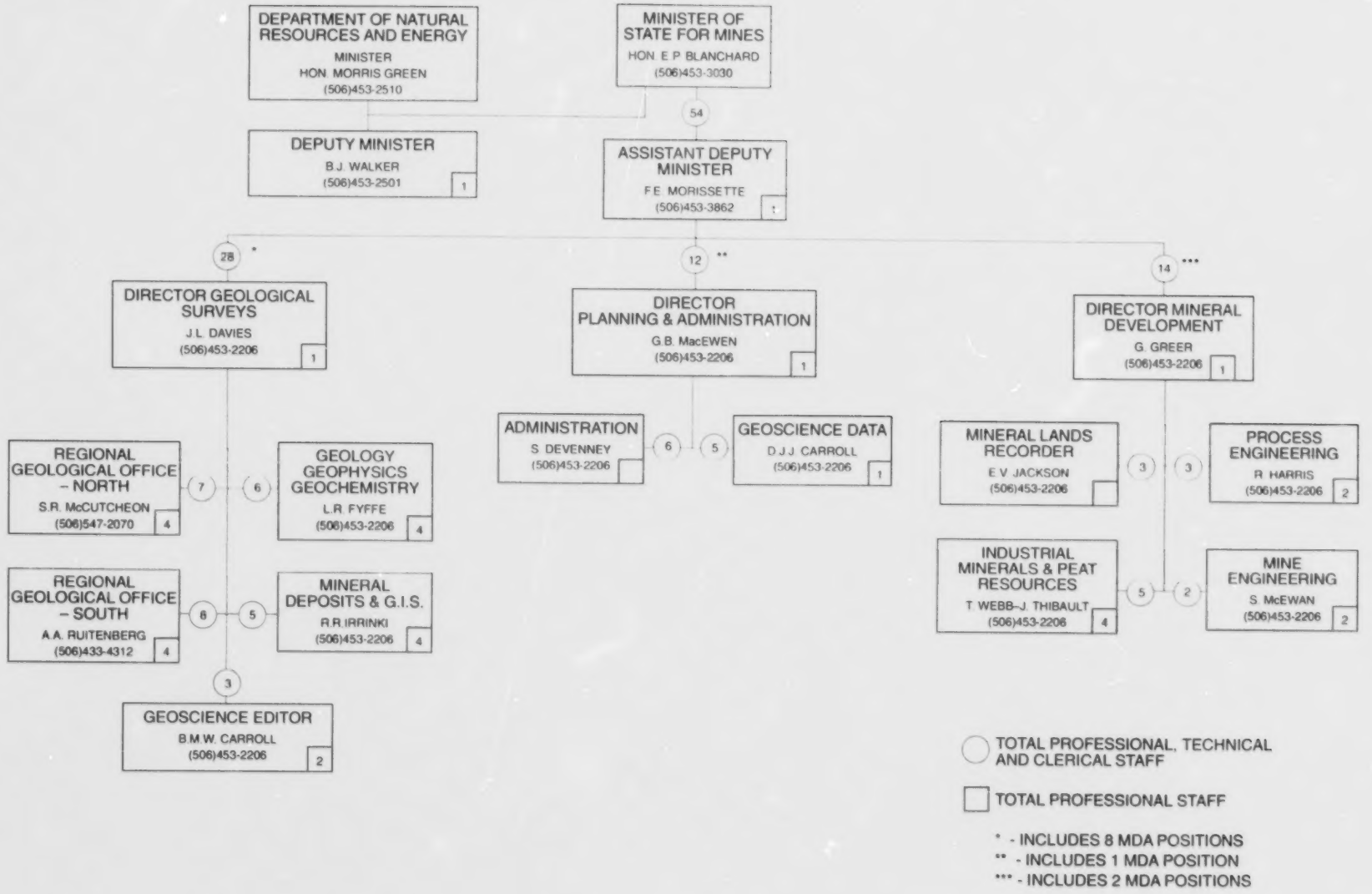
(Sept.1990 - Aug. 1991)



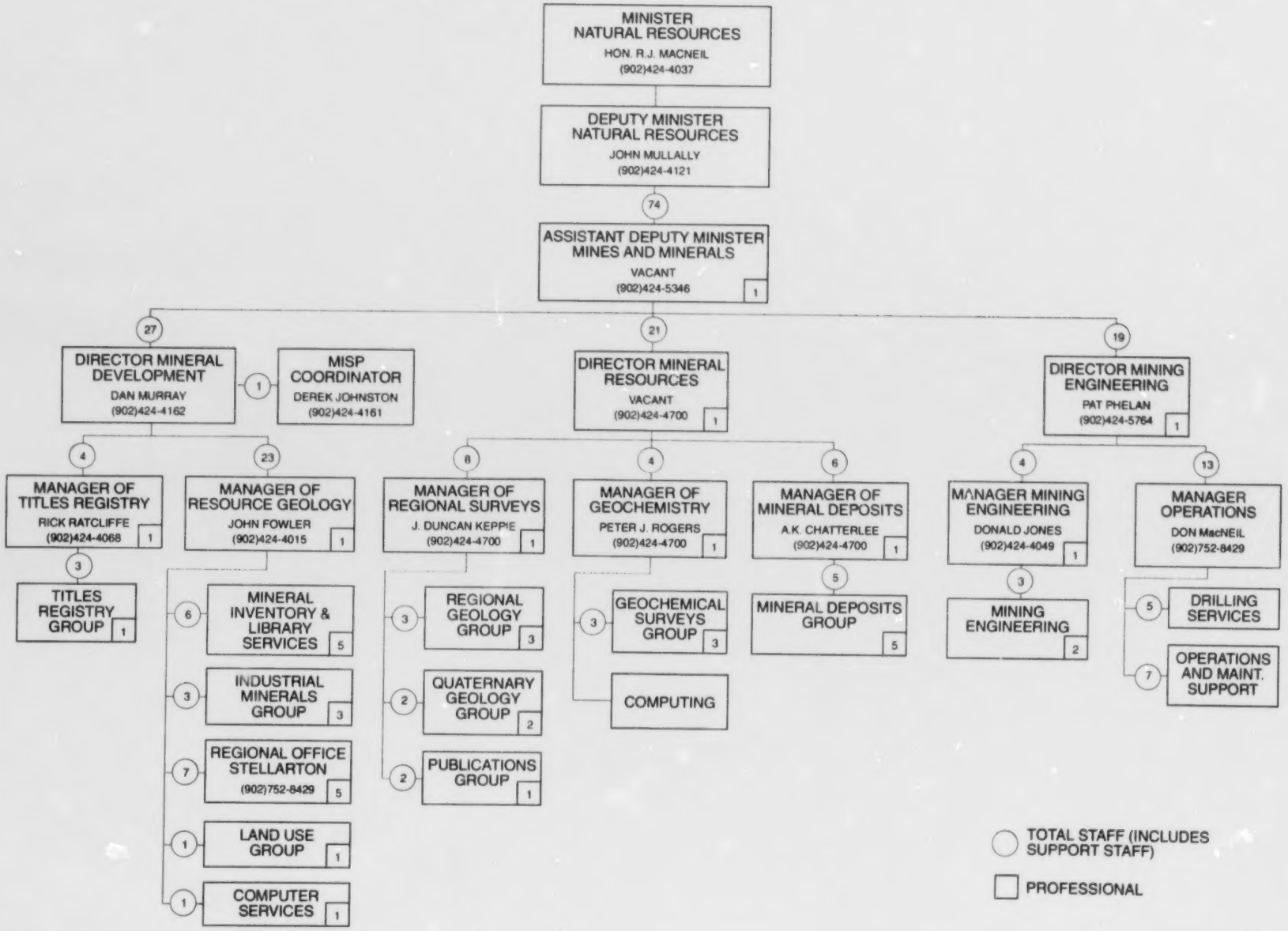
ORGANIGRAMMES DU MINISTÈRE DE L'ÉNERGIE ET DES RESSOURCES (MINES) DU QUÉBEC



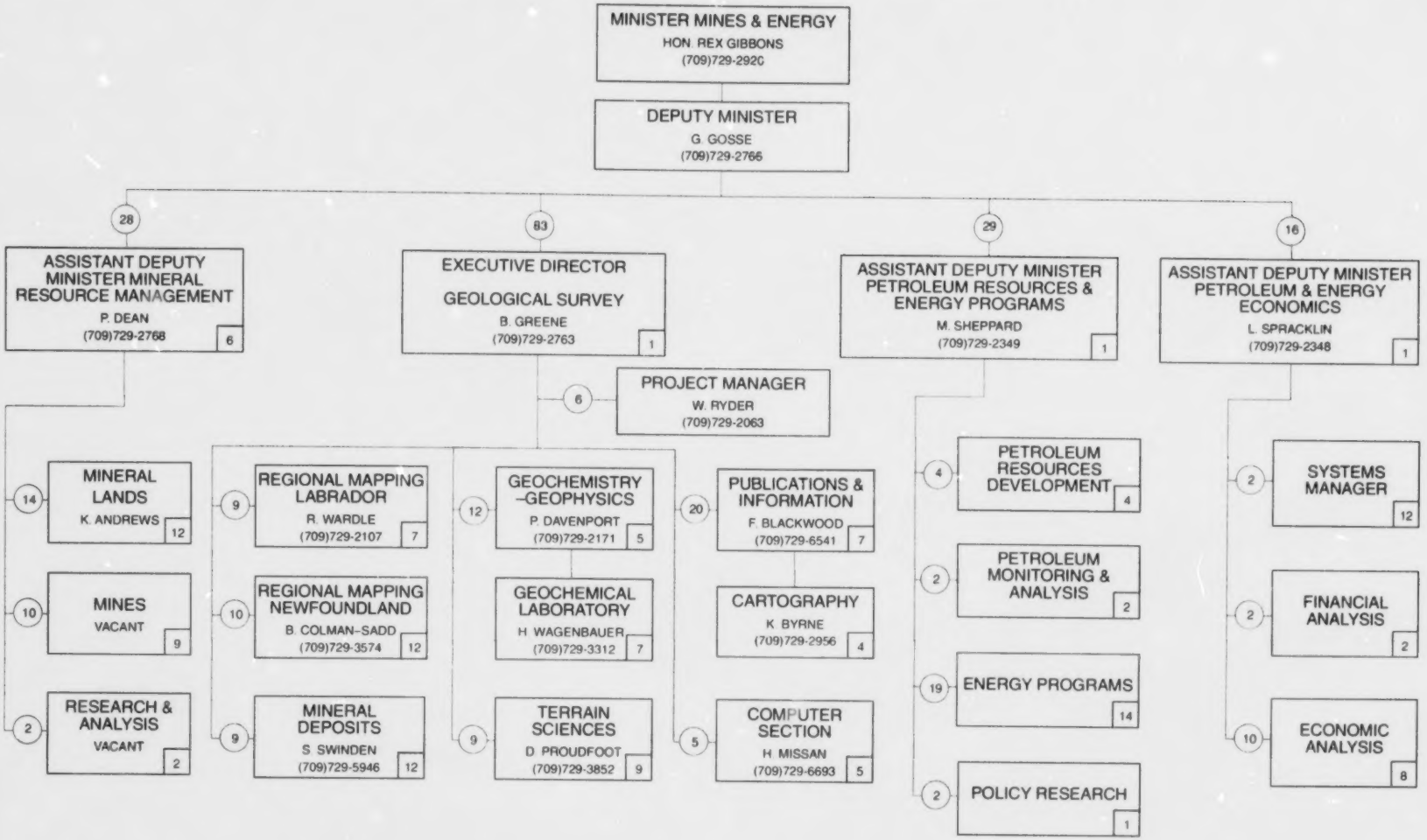
NEW BRUNSWICK GEOSCIENCE ORGANIZATION CHART



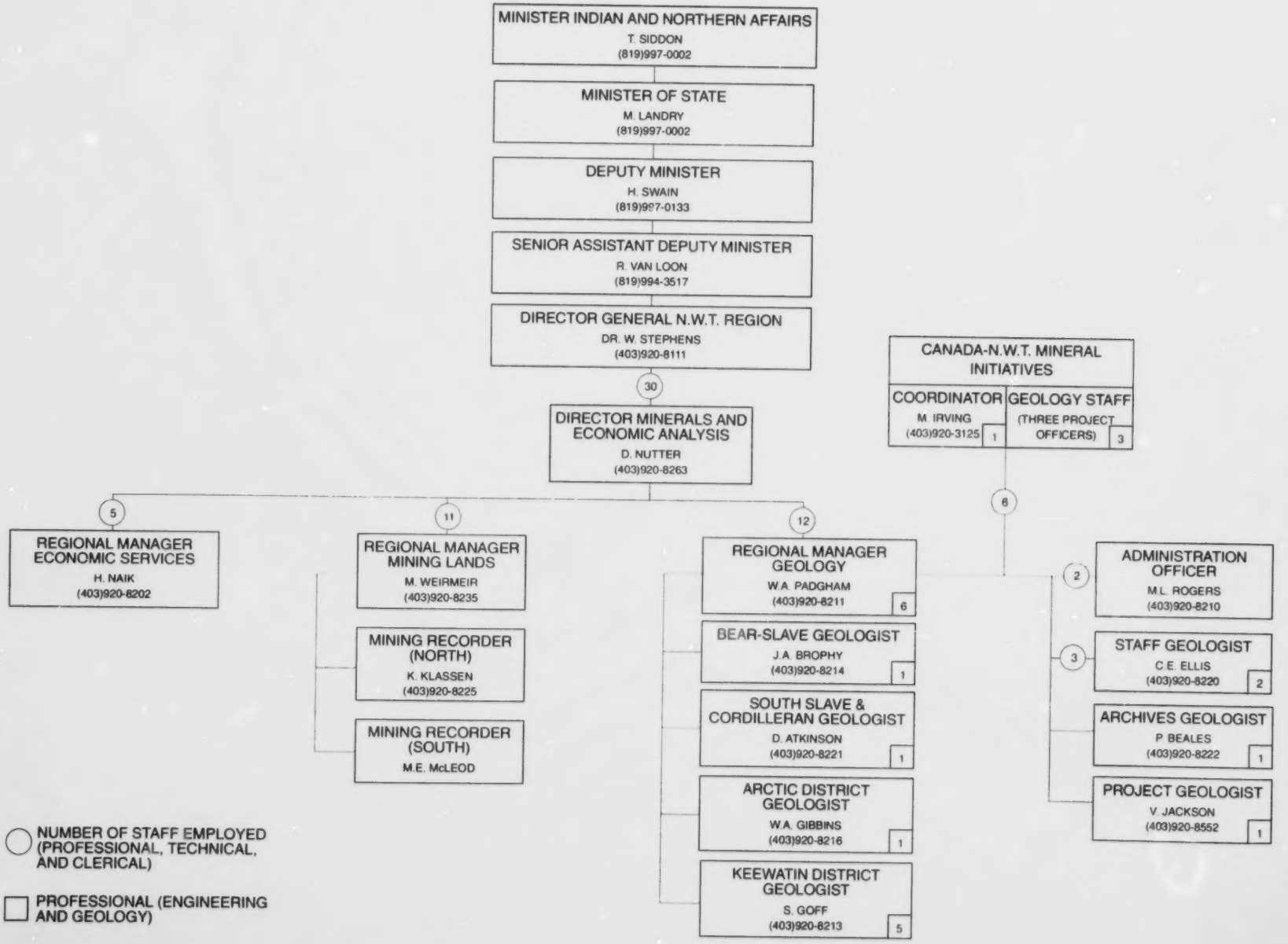
NOVA SCOTIA GEOSCIENCE ORGANIZATION CHART



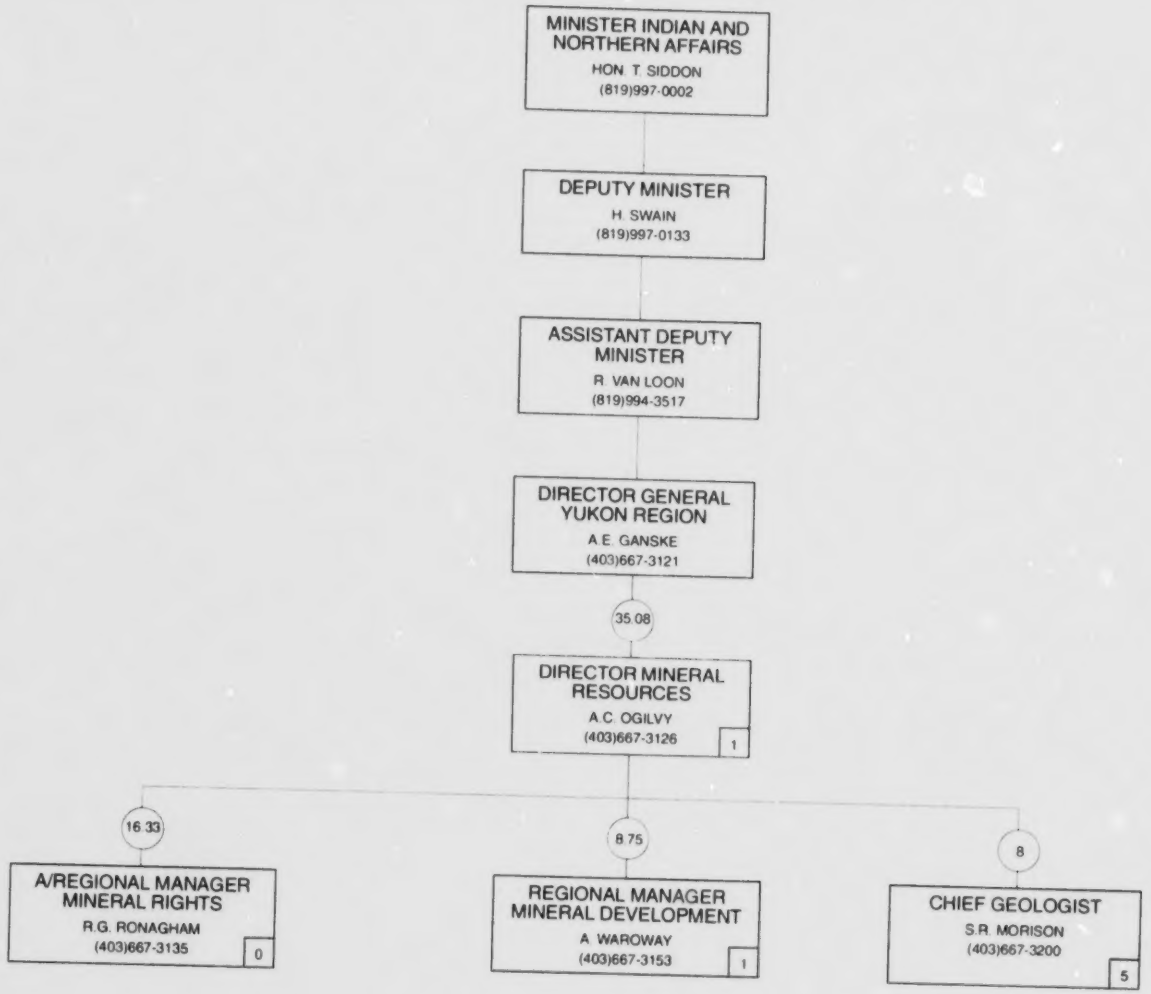
NEWFOUNDLAND GEOSCIENCE ORGANIZATION CHART



NORTHWEST TERRITORIES GEOSCIENCE ORGANIZATION CHART



YUKON GEOSCIENCE ORGANIZATION CHART



◯ NUMBER OF STAFF EMPLOYED (PROFESSIONAL, TECHNICAL, AND CLERICAL)

☐ PROFESSIONAL (ENGINEERING AND GEOLOGY)

PROVINCIAL GEOLOGICAL SURVEY EXPENDITURES, 1990–1991

PROVINCIAL GEOSCIENCES EXPENDITURES
1990 - 1991

PROVINCE/ TERRITORY	SURVEY EXPENDITURES $ X 10^6	% OF TOTAL	ESTIMATED 1990 VALUE OF PROVINCIAL MINERAL PRODUCTION[1] $ X 10^3	SURVEY EXPENDITURES AS % OF TOTAL VALUE OF PROVINCIAL MINERAL PRODUCTION	AREA OF PROVINCE/ TERRITORY KM^2 X 10^3	SURVEY $ SPENT/KM^2	POPULATION (1986) X 10^3	SURVEY $ SPENT/ CAPITA
NEWFOUNDLAND	4.8	6.4	861 573	.55	405	11.8	568	8.5
NOVA SCOTIA	3.8	5.1	253 088	1.50	55	69.1	873	4.4
PRINCE EDWARD ISLAND	-	-	3 311	-	6	-	127	-
NEW BRUNSWICK	2.3	3.0	848 692	.27	73	31.5	709	3.2
QUEBEC	17.3	23.0	2 967 787	.58	1 541	11.2	6 532	2.6
ONTARIO	19.9	26.5	6 323 845	.30	1 069	18.6	9 102	2.2
MANITOBA	3.6	4.7	1 111 716	.32	650	5.5	1 063	3.4
SASKATCHEWAN	4.4	5.9	1 114 935	.39	652	6.7	1 010	4.3
ALBERTA	8.6	11.4	1 107 627[2]	.78	661	13.0	2 366	3.6
BRITISH COLUMBIA	7.8	10.4	2 141 247	.37	948	8.2	2 883	2.7
YUKON	1.4	1.9	541 132	.26	483	2.9	24	58.3
NORTHWEST TERRITORIES	1.3	1.7	906 414	.14	3 380	.4	52	25.0
TOTALS	75.2	100.0	20 263 628	-	9 923	-	25 309	-

[1]Source : Northern Mining Magazine, March 1991
[2]Includes coal

PROVINCE: BRITISH COLUMBIA
1990-1991

Programs	Survey research agency	Funding agency	No. of projects (or facilities)	Permanent SMY	Casual SMY	Casual & permanent $	Operating expenditures $	Totals
Chief's Office	GSB (MRD)	EMPR	-	4	-	175 000	235 000	410 000
Vancouver Office	GSB (MRD)	EMPR	4	3	-	141 000	43 000	184 000
Geoscience Grants	GSB (MRD)	EMPR	21	-	-	-	130 000	130 000
Geochemistry	GSB (MRD)	EMPR	3	2	1	273 000	72 000	345 000
	GSB (MRD)	MDA	1	-	.5	20 000	112 000	132 000
Surficial Geology	GSB (MRD)	EMPR	3	3	.5	200 000	150 000	350 000
Regional Mapping	GSB (MRD)	EMPR	6	10	6	853 000	215 000	1 068 000
	GSB (MRD)	MDA	1	-	2	60 000	33 000	93 000
Mineral Deposits	GSB (MRD)	EMPR	5	8	7	808 000	228 000	1 036 000
	GSB (MRD)	MDA	1	-	1	30 000	11 000	41 000
Coal Resources	GSB (MRD)	EMPR	7	6	2.5	428 000	188 000	616 000
Industrial Minerals	GSB (MRD)	EMPR	2	2	1.5	172 000	168 000	340 000
Prospectors Assistance and Training (FAME)	GSB (MRD)	EMPR	3	-	2	50 000	450 000	500 000
Land Use	GSB (MRD)	EMPR	-	-	-		62 000	62 000
Mineral Deposits Inventory and Analysis	GSB (MRD)	EMPR	2	7	3.5	505 000	293 000	798 000
	GSB (MRD)	MDA	-	-	-	-	3 000	3 000
District Geology	GSB (MRD)	EMPR	5	7.5	4.5	613 000	239 000	852 000
Scientific Review/Publications	GSB (MRD)	EMPR	-	5	-	234 000	246 000	480 000
	GSB (MRD)	MDA	-	-	-	-	31 000	31 000
Laboratory Analysis	GSB (MRD)	EMPR	-	6	-	188 000	186 000	374 000
Oil and Gas Inventory and Analysis	PGB (ERD)	EMPR	1	5	-	418 000	20 000	438 000
Petroleum Subsurface Investigations and Land Use	PGB (ERD)	EMPR	1	3	-	251 000	30 000	281 000
TOTALS								
GSB (MRD)	-	-	-	69.5	26.5	4590 000	2 455 000	7 045 000
MDA	-	-	-	-	3.5	110 000	190 000	300 000
PGB (ERD)	-	-	-	10	-	669 000	50 000	719 000
FAME	-	-	-	-	2	50 000	450 000	500 000

GSB (MRD) - Geolgocial Survey Branch (Mineral Resources Division)
PGB (ERD) - Petroleum Geolgocial Branch (Energy Resources Division)
EMPR - Minsitry of Energy, Mines and Petroleum Resources
MDA - Canada - B.C. Mineral Development Agreement
FAME - Financial Assistance for Mineral Exploration (Funded by Province of British Columbia)

PROVINCE: ALBERTA
1990-1991

Programs	Survey research agency	Funding agency	No. of projects (or facilities)	Permanent SMY	Casual SMY	Permanent $	Salaries casual $	Supplies and serivces $
Chief's Office	ARC/ERCB	ARC/ERCB	5	5.6	-	424.9	-	29.4
Core Repositories	ARC/ERCB	AE	2	32.7	0.1	1 014.3	3.6	14.3
Geological Survey, Surficial:								
1) Reconnaissance (1:100 000)	ARC	ARC/AE	6	1.8	0.2	163.6	8.2	21.0
2) Reclamation/Environmental Impact	ARC	CANAG/ALTAAG ARC/TRANSALTA	7	2.3	-	211.0	-	52.5
Hydrogeological	ARC	ARC/AE	6	0.2	-	21.8	-	58.2
Information and Education	ARC	ARC/AE	6	3.0	0.2	246.2	6.4	178.4
Laboratory Analysis	ARC	ARC/AE	1	0.8	-	62.1	-	2.8
Mineral Deposit Inventory Analysis	ARC	ARC/AE	8	1.6	0.3	151.3	15.6	79.6
Energy Resources Inventory and Research:								
1) Petroleum and Natural Gas	ARC/ERCB	ARC/ERCB/AE	9	35.7	0.3	1 734.1	12.3	122.9
2) Oil Sands	ARC/ERCB	ARC/AOSTRA AE/ERCB	15	15.7	0.3	1 122.4	10.8	222.4
3) Coal Geology	ARC	ARC/AE	16	6.6	0.7	542.6	32.5	433.3
Stratigraphic Research	ARC/ERCB	ARC/ERCB/AE	3	6.2	0.5	448.7	27.4	89.8
Other	ARC/ERCB	ARC/ERCB	9	15.8	0.1	952.5	0.9	84.5
TOTALS	-	-	-	**128.0**	**2.7**	**7 095.5**	**117.7**	**1 389.1**
							TOTAL	8 602.3

ARC - Alberta Research Council
CANAG - Agriculture Canada
AOSTRA - Alberta Oil Sands Technical Research Authority
TRANSALTA - TransAlta Utilities Ltd.
AE - Alberta Department of Energy
ALTAAG - Alberta Agriculture
ERCB - Energy Resources Conservation Board

PROVINCE: SASKATCHEWAN
1990-1991

Programs	Survey research agencies	Funding agency	No. o projects/ facilities	Salaries				Operating expenditures $	Totals
				Permanent SMY	Casual SMY	Permanent $	Casual $		
Administration	SGS	SGS	N/A	4.25	.25	210 000	10 000	123 000	343 000
	SRC	SRC	N/A	9.00	-	292 300	-	40 000	332 300
Core Repositories (Phanerozoic)	SGS	SGS	1	6.00	-	244 500	25 000	123 000	392 500
:(Precambrian)	SGS	SGS	1	0.30	0.30	-	8 650	10 050	18 700
Geochemical Surveys (Bedrock)	SGS/UofR	SGS	1	-	-	-	-	15 000	15 000
(Surficial/Drift Prospecting)	SRC	SRC	2	1.00	-	40 000	-	-	40 000
Geological Surveys, Bedrock:									
:Detailed (typically 1:20 000)	SGS	SGS	5	2.00	4.25	115 000	156 500	93 950	365 450
:Reconnaissance (1:100 000)	SGS	SGS	-	-	-	-	-	-	0
:Compilation (1:250 000 or less)	SGS	SGS	1	-	1.30	-	56 050	-	56 050
Geological Surveys, Surficial	SRC	SRC	1	0.10	0.33	4 000	-	90 000	94 000
Geophysical Surveys	-	-	-	-	-	-	-	-	0
Hydrogeological Surveys	SRC	SRC	-	1.00	-	40 000	-	75 000	115 000
Information and Education	SGS	SGS	1	0.25	-	13 000	-	16 650	29 650
Laboratory Analyses and Studies:									
:Isotope Geochronology	UofR/UofS/ RofM/UofC	SGS	3	-	-	-	-	88 250	88 250
:Enhanced geomagnetics	SGS	SGS	1		0.40		15 000	16 150	31 150
:other	SRC	SRC		1.00		40 000	-	40 000	80 000
Mineral Deposit Inventory/Analysis									
:including Industrial Minerals and	SGS	SGS	3	5.25	1.25	251 600	29 000	10 000	290 600
:Metallogenic Maps	SRC	SRC	3	3.00	-	120 000	-	200 000	320 000
Oil and Gas Inventory and Analysis	SGS	SGS	-	8.00	-	251 000	12 000	21 000	284 000
Publications/Cartography/ Computerization	SGS	SGS	-	6.00	1.00	295 000	-	166 750	461 750
Resident Geologist's Offices	SGS	SGS	1	3.75	-	148 000	-	26 600	174 600
Subsurface (Stratigraphic) Studies	SGS	SGS	5	4.00	1.00	225 000	-	48 000	273 000
Water Resource Inventory/Analysis	SRC	SRC	10	4.00	0.30	160 000	-	100 000	260 000
Metallogenic/Mineral Deposit Studies	SGS/UofS UofW	SGS	10	2.25	1.25	115 000	48 600	154 000	317 600
TOTALS	-	-	49	61.15	11.63	2 564 400	360 800	1 457 400	4 382 600
Grand Total	$4 382 600								

NOTE: Some allocations are approximated, grand total is accurate.
SGS - Saskatchewan Geological Survey, Department of Energy and Mines, operations funded under Canada-Sask. Partnership Agreement on Mineral Development 1990-91; SRC - Saskatchewan Research Council; UofR - University of Regina; UofS - University of Saskatchewan; UofC - University of California (Santa Cruz); UofW - Univ. of Waterloo. University contribution to funding is not included in these figures.

PROVINCE: MANITOBA
1990-1991

Programs	Survey research agency	Funding agency	No. OF projects (or facilities)	Permanent SMY	Casual/ term SMY	Salaries Permanent $	Salaries Casual $	Operating expenditures $	Total
Core Repositories	MGS	MAN	1	.26	-	21 300	-	18 700	40 000
Geochemical Surveys									
1) Bedrock	-	-	-	-	-	-	-	-	-
2) Drainage	-	-	-	-	-	-	-	-	-
3) Soil	MGS	MAN	2	1.00	1.39	53 700	41 500	17 500	112 700
4) Peat	-	-	-	-	-	-	-	-	-
Geological Surveys, Bedrock									
1) Reconnaissance (1:10[illegible]000)	-	-	-	-	-	-	-	-	-
2) Detailed (1:50 000)	MGS	MAN	15	10.00	1.28	514 000	26 500	54 000	594 500
3) Phanerozoic	MGS	MAN	3	1.00	.13	42 100	4 400	4 200	50 700
Geological Surveys, Surficial									
1) Reconnaissance (1:100 000)	-	-	-	-	-	-	-	-	-
2) Detailed (1:50 000)	MGS	MAN	2	-	-	-	-	8 100	8 100
3) Resource Management	-	-	-	-	-	-	-	-	-
Geophysical Surveys									
1) Airborne Electromagnetic	-	-	-	-	-	-	-	-	-
2) Airborne Magnetic, Gradiometer	MGS	MAN	1	1.00	-	53 700	-	5 400	59 100
3) Ground Magnetic	-	-	-	-	-	-	-	-	-
4) Gravity	-	-	-	-	-	-	-	-	-
5) Seismic	-	-	-	-	-	-	-	-	-
6) Radiometric	-	-	-	-	-	-	-	-	-
7) Remote Sensing	-	-	-	-	-	-	-	-	-
Hydrogeological Surveys	-	-	-	-	-	-	-	-	-
Information, Education, Assessment Services and Compilation	MGS	MAN	11	4.20	4.14	166 200	127 100	75 200	368 500
Laboratory Analysis	MGS	MAN	3	10.12	3.00	378 400	80 600	82 000	541 000
Mineral Deposit Inventory and Analysis	MGS	MAN	23	5.00	4.30	272 600	182 800	114 900	570 300
Industrial Minerals	MGS	MAN	5	1.00	1.39	49 000	57 900	18 000	124 900
Oil, Gas Inventory and Analysis	-	-	-	-	-	-	-	-	-
Publications	MGS	MAN	34	-	-	-	-	55 900	55 900
Resident Geologist's Office	MGS	MAN	2	1.18	-	54 500	-	5 800	60 300
Subsurface Invest, Indust Min Drilling and Management	MGS	MAN	5	-	.50	-	45 300	37 400	82 700
Water Resource Inventory and Analysis	-	-	-	-	-	-	-	-	-
Other:									
1) Administration	MGS	MAN	-	5.00	2.04	185 900	53 000	190 700	[1] 429 600
2) Drafting	MGS	MAN	-	11.00	1.00	384 600	28 900	18 600	432 100
3) Uranium/Lead			1	-	-	-	-		
4) Computerized Data Capture	MSG	MAN	2	-	1.00	-	31 800	500	32 300
TOTALS	-	-	-	51.24	22.09	2 176 000	679 800	706 900	3 562 700

MGS - Manitoba Geological Services Branch
1 - Includes Field Equipment, Capital and Computerization

PROVINCE: ONTARIO
1990-1991

Programs	Funding agency	No. of projects (or facilities)	Person-years		Salaries		Operating expenditures $	Totals $
			Permanent	Casual	Permanent $	Casual $		
Administration (Director's Office OGS)	MNDM	-	8	2	345.2	69.4	213.8	628.4
Libraries	MNDM	7	11	-	361.8	-	141.6	503.4
Geophysical Airborne Electro-magnetic Surveys	NDF	6	-	3	-	120.0	2 527.62	647.6
Other Geophysical Surveys/ Research	MNDM	6	10	3	454.8	103.0	375.3	933.1
Geochemical Surveys/Research	MNDM	2						
Geological Surveys:								
Precambrian	MNDM	32	30	14	1 578.1	417.4	802.8	2 798.3
Phanerozoic	MNDM	5						
Quaternary	MNDM	7	18	4	850.5	125.0	355.0	1 330.5
Aggregate	MNDM	9						
Geoservices (OGS)								
Publications	MNDM	-	14	8	565.2	229.9	1 055.1	1 850.2
Laboratory Analysis	MNDM	-	32	3	1 202.7	106.9	622.6	1 932.2
Equipment, Vehicles	MNDM	-	4	1	214.1	44.7	304.5	563.3
Information, Education, Library, Assessment Files	MNDM	-	13	4	484.2	102.6	927.6	1 514.4
Resident Geologist's Office	MNDM	15	54	4	2 325.1	102.7	932.7	3 360.5
Geoscience Research Grants Programs	MNDM	20	-	-	-	-	629.3	629.3
Other Geological Research Grants	MNDM	12	-	-	-	-	506.0	506.0
COMDA	CAN/ONT	18	-	15	-	450.7	300.5	751.2
TOTALS	-	-	**194**	**61**	**8 381.7**	**1 872.3**	**9 694.4**	**19 948.4**

MNDM - Ministry of Northern Development and Mines
COMDA - Canada-Ontario 1985 Mineral Development Subsidiary Agreement - provincial delivered geoscience projects only
NDF - Ontario Northern Development Fund
OGS - Ontario Geological Survey

Note: $ Values in 1,000's

PROVINCE: QUÉBEC
1990-1991

Programs	Matre d'oeuvre	Financement	Nombre de projets ou d'installations	Employés permanents pers.-année (c-p-a-)**	Employés occasionnels pers.-année	Budget alloué
1) Levés géologiques			-	-	-	-
a) Côte-Nord et Nouveau-Québec	DGEGM	MER	18	5P-1A	3	1 635 900
b) Montréal-Laurentides	DGEGM	MER	6	3P-1A	2	384 700
c) Gaspésie-Les Iles	DGEGM	MER	6	2P-1A	1	457 900
d) Estrie-Laurentides	DGEGM	MER	13	4P-2A	2	985 100
e) Minéraux Industriels du Québec	DGEGM	MER	4	2P-1A	1	357 900
f) Rouyn-Noranda	DGEGM	MER	16	3P-3A	2	1 147 800
g) Val-d'Or	DGEGM	MER	10	3P-1A	5	982 700
h) Chibougamau	DGEGM	MER	10	3P-2A	2	904 000
2) Bases de donnees	DGEGM	MER	-	2A	4	225 500
3) Supervision et controle	DGEGM	MER	-	2C-10P-4A	8	951 300
4) Gestion et planification	DGEGM	MER	-	2C-2P-2A	3	380 900
5) Opérations (équipement de terrain, informatique, etc.)	DGEGM	MER *	-	1P-3A	5	1 446 000
6) Assistance financière	DGEGM	MER/EMR	138	1C	4	3 086 300
7) Géoinformation	DGEGM	MER	-	2C-6P-16A	2	2 484 800
8) Information geoscientifique	DGEGM	MER	-	1C-4P-9A	10	1 344 400
9) Gestion interne	DGEGM	MER	-	2C-1P-4A	5	360 900
10) Communication	DGEGM	MER	-	1A	-	167 500
TOTAUX	-	-	-	10C-49P-53A	59	17 303 600

DGEGM - Direction générale de l'exploration géologique et minérale
MER - Ministère de l'Energie et des Ressources du Québec
EMR - Energy, Mines and Resources, Ottawa
* - Entente auxiliaire Canada-Québec sur le développement minéral
** - C = cadre
P = professionnel
A = autre

PROVINCE: NEW BRUNSWICK
1990-1991

Programs	Agency	No. of projects	Staff Permanent	Staff Casual	Staff Contracts	Salaries	Operating expenditures	Totals
Geophysics	GSB	1	-	-	-	-	35,600	35 600
Geological Surveys:								
Bedrock	GSB	5	5.0	1.00	-	256,800	116,300	373 100
Surficial	GSB	1	1.0	0.75	-	60,800	22 000	82 800
Geochemical Surveys	GSB							
Till	GSB	1	0.5					
Drainage	GSB	1	2.5	1.00	-	120 000	55 200	175 300
Mineral Deposits	GSB	2	1.5	1.00	-	87 000	33 900	120 900
Regional Offices	GSB	2	5.0	0.25	-	252 900	96 300	349 200
Geoscience Information System	GSB	1	0.5	-	-	25 000	27 300	52 300
Diamond Drill Core Management	GSB	3	0.5	-	-	44 100	17 000	61 000
Publications (Editorial)	GSB	1	1.0	-	-	-	-	-
Grants to Prospectors	GSB	1	-	-	-	-	81 000	81 000
Prospecting Courses	GSB	1	-	-	-	-	22 300	22 300
Directors Office	GSB	1	2.0	-	-	85 400	23 900	109 300
Information, Education	PAB	3	3.0	-	-	100 000	15 000	115 000
Industrial Minerals	MDB	3	2.0	-	-	116 700	20 000	136 700
Peat Resources	MDB	1	1.0	-	-	47 100	10 300	57 400
Coastal Zone	MDB	1	1.0	-	-	35 000	10 000	45 000
Coal, Oil, Gas. Oil Shale	ERB	2	-	-	-	84 000	50 000	134 000
Canada-New Brunswick Agreement	GSB	10	-	2.5	9	315 000	231 702	546 702
		40	27.5	6.5	9	1 629 800	636 100	2 265 900

GSB - Geological Surveys Branch: MDB - Mineral Development Branch
PAB - Planning and Administration Branch; ERB = Energy Resouces Branch

PROVINCE: NOVA SCOTIA
1990-1991

Programs	Survey research agency	Funding agency	No. of projects (or facilities)	Permanent staff man-years	Casual staff man-years	Budget allocations $
Core Repositories	NSDME	NSDME/NSDITT	3	4	1	101 585
Geochemical Surveys:	NSDME	NSDME/NSDITT	1	4	-	166 257
1) Bedrock	-	-	-	-	-	-
2) Drainage	-	-	-	-	-	-
3) Soil	-	-	-	-	-	-
Geological Surveys, Bedrock:						
1) Reconnaissance (1:100 000)	-	-	-	-	-	-
2) Detailed (1:50 000)	NSDME	NSDME/NSDITT	3	7	-	455 309
Geological Surveys, Surficial:						
1) Reconnaisance (1:100 000)	-	-	-	-	-	-
2) Detailed (1:50 000)	NSME	NSME/NSDITT	1	2	-	55 144
Geophysical Surveys:						
1) Airborne Radiometrics	-	-	-	-	-	-
2) Airborne Magnetic (includes VLF-EM)	-	-	-	-	-	-
3) Ground Magnetic	-	-	-	-	-	-
4) Gravity	-	-	-	-	-	-
5) Seismic	-	-	-	-	-	-
Hydrogeological Surveys	-	-	-	-	-	-
Information and Education	NSDME	NSDME/NSDITT	3	6	2	482 145
Laboratory Analysis	-	-	-	-	1	-
Mineral Deposit Analysis	NSDME	NSDME/NSDITT	7	10	2	797 938
Coal and Peat	NSDME	NSDME/NSDITT	3	3	-	347 737
Oil and Gas Inventory and Analysis	NSDME	NSDME/NSDITT	2	3	-	577 400
Publications	NSDME	NSDME/NSDITT	N/A	6	-	237 513
Resident Geologist's Office	NSDME	NSDME	N/A	3	-	213 735
Subsurface Investigations	NSDME	NSDME	N/A	4	-	354 600
TOTALS	-	-	23	52	6	3 789 363

NSDME = Nova Scotia Department of Mines and Energy
NSDITT = Nova Scotia Department of Industry, Trade and Technology

PROVINCE: NEWFOUNDLAND
1990-1991

programs	Survey research agency	Funding agency	No. of projects (or facilities)	Permanent[1] SMY	Casual SMY	Salaries Permanent $	Salaries Contract[1] $	Casual $	Operating expenditures $
Director's Office	NDME	NDME	2	8	-	250 256	24 661	-	80 826
Core Repositories	NDME	NDME	1	2	2	93 779	-	7 026	36 936
Geochemical Surveys:									
1) Bedrock	-	-	-	-	-	-	-	-	-
2) Drainage	NDME	NDME	5	5	4	156 057	70 327	16 775	90 803
3) Soil	-	-	-	-	-	-	-	-	-
Geological Surveys, Bedrock:									
1) Reconnaisance (1:100 000)	NDME	NDME	6	7	7	248 499	64 000	43 460	266 880
2) Detailed (1:50 000)	NDME	NDME	9	12	4	294 991	263 642	20 009	117 891
Geological Surveys, Surficial:									
1) Reconnaisance (1:100 000)	-	-	-	-	-	-	-	-	-
2) Detailed (1:50 000)	NDME	NDME	4	5	4	166 940	71 393	24 092	67 392
Geophysical Surveys:									
1) Airborne Electromagnetic	-	-	-	-	-	-	-	-	-
2) Airborne Magnetic	-	-	-	-	-	-	-	-	-
3) Ground Magnetic	NDME	NDME	1	2	-	-	69 819	-	5 015
4) Gravity	-	-	-	-	-	-	-	-	-
5) Seismic	-	-	-	-	-	-	-	-	-
6) Radiometric	-	-	-	-	-	-	-	-	-
Hydrogeological Surveys	-	-	-	-	-	-	-	-	-
Information and Education	NDME	NDME	3	13	-	273 949	146 045	-	118 298
Laboratory Analysis	NDME	NDME	2	8	-	286 129	-	-	91 221
Mineral Deposit Inventory and Analysis	NDME	NDME	9	15	5	335 887	328 076	36 022	160 161
Publications	NDME	NDME	3	14	-	249 011	122 040	-	114 174
Resident Geologist's Office	-	-	-	-	-	-	-	-	-
Subsurface Investigations	-	-	-	-	-	-	-	-	-
Water Resource Inventory and Analysis	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
TOTALS	-	-	45	91	26	2 355 498	1 160 003	147 384	1 149 597
Grand Total	**4 812 482**								

[1]Includes long term temporary staff
NDME - Newfoundland Department of Mines and Energy
DEMR - Department of Energy, Mines and Resources, Canada

PROVINCE: NORTHWEST TERRITORIES
1990-1991

Programs[2]	Survey research agency	Funding agency	No. of projects (or facilities)	Salaries[1] Permanent SMY	Casual SMY	Permanent $	Casual/ Temporary $	Operating expenditures $
Head Office (Administration, General Support)	NWT GD	DIAND	1	5.4	-	250	-	120
Head Office (Administration, General Support)	MDA	MDA	1	-	1.5	-	-	133
Core Repositories	NWT GD	DIAND	1	0.1	-	10	-	5
Geological Surveys:								
Bedrock (1:50000)	NWT GD	DIAND	5	1.0	2.5	50	100	132
Bedrock (1:50000)	MDA	MDA	3	-	6	-	-	399
Surficial (1:50000)	NWT GD	DIAND	2	0.1	-	5	-	15
Education	NWT GD	DIAND	-	0.3	-	25	-	5
Education	MDA	MDA	-	-	-	-	-	76
Laboratory Analysis	NWT GD	DIAND	-	-	-	-	-	12
Mineral Deposit Inventory and Analysis	NWT GD	DIAND	-	1.3	-	50	-	90
Mineral Deposit Inventory and Analysis	MDA	MDA	2	-	2.3	-	-	168
Publications	NWT GD	DIAND	9	2.6	1.1	125	57	20
Publications	MDA	MDA	3.3[3]	-	0.9	-	-	29
Other:								
Prospectors' Assistance	NWT GD	DIAND	-	0.5	.1	10	-	-
Geological Contracts	NWT GD	DIAND	9	-	-	-	-	65
MDA Contracts	MDA	MDA	2	-	-	-	-	12
NWT GD Totals	-	-	-	**11**	**3.7**	**500**	**157**	**459**
MDA Totals	-	-	-		10.7	-	-	812
GRAND TOTALS (Geoscience)	-	-	-	11.5	14.4	500	157	1271
GSC managed Canada-NWT MDA Projects		-	11	-	-	-	-	231

NWT GD - Northwest Territories Geology Division (DIAND)
MDA - Mineral Development Agreement (Canada-NWT Government)

1. MDA personnel expenditures are included in O&M.
2. Geoscience only
3. 13 MDA Reports and 19 Geological information folios available through NWT GS Archives Section.

PROVINCE: YUKON
1990-1991

programs	Survey research agency	Funding agency	No. of projects (or facilities)	Permanent PY	Casual PY	Salaries Permanent $	Casual $	Operating expenditures $	
Head Office (Administration, General Support)	INA	INA	1.0	2.5	-	95 000	-	139 900	
Core Repositories	INA	INA	1.0	0.3	0.25	14 000	7 200	78 000	*
								0	
Geochemical Surveys	EMR	EMR/INA	1.5					0	
1) Drainage		EDP						550 000	
Geological Surveys Bedrock:	INA	INA	2.0	0.5		29 000	59 000		
1) Detailed (1:50 000)		EDP						70 700	**
Geological urvey, urficial	INA	INA	1.0	0.5	0.25	35 000		5 000	
Education	INA	INA	1.0					9 000	
								0	
Mineral Depoit Inventory and	INA	INA	5.0	3.0	0.58	85 000	14 000	70 000	
Laboratory Analyi	EMR	EDP						343 100	***
Publication	INA	INA	12.0	1.0	0.5	85 000	14 700	43 500	
		EDP						21 900	
TOTAL	-	-	26.5	7.8	1.58	343 000	36 300	405 100	A-B
								985 700	EDP
								1 390 800	

INA - Indian and Northern Affair Canada
EDP - Canada - Yukon Economic Development Agreement
EMR - Energy, Mine and Reource Canada
A-B - A-Base funding (including capital expenditure)

*include capital expenditure for facility improvement
**EDP hardrock mapping by contract only
***includes geochem analysis of archived samples & MINFILE project

GEOLOGICAL PROGRAM HIGHLIGHTS

BRITISH COLUMBIA MINISTRY OF ENERGY, MINES AND PETROLEUM
GEOLOGICAL SURVEY BRANCH

Reorganization of the Branch, following a major review by the Canadian Geoscience Council, was implemented in April 1991. The Branch now comprises six sections, three are focused primarily on enhancing the geoscience database, two are charged predominatly with ensuring this database is available to clients in industry, government and the public.

Field work continued at a moderate pace in 1991, assisted by a modest budget increase of $260,000.

Negotiations towards renewal of the successful Mineral Development Agreement were at an advanced stage in April. The Branch received approval from Treasury Board to initiate three geoscience projects, under the Provincial share of the new agreement, in advance of the formal agreement being signed.

During 1991 the Geological Survey Branch also carried out field assessments of the mineral potential for two Candidate Park Study Areas; the Babine Mountains Recreation Area, and the Kakwa Recreation Area. Funding for these assessments was provided by the Ministry of Parks.

MAPPING AND RESOURCE EVALUATION SECTION

Regional Mapping

Regional geological survey activities were again at a moderate level in 1991.

Jim Logan and John Drobe extended their research into the More Creek area. There, late Paleozoic metavolcanic and plutonic rocks of the Stikine assemblage form the basement to Triassic strata of the Stuhini Group as well as to the Lower Jurassic Hazelton and younger rocks. Sequences in the area are tentatively correlated with the well publicized Eskay facies, host to the Eskay Creek gold deposit. Derek Brown and Jay Timmerman extended mapping in the Stikine, begun in 1988, to the west and north. Rock formations are similar to those to the south but the structural-stratigraphic fabric is nearly east-west, rather than along the northwest grain of the Cordillera. The Stuhini Group in this area is dominated by volcaniclastic and epiclastic rocks and there is potential for polymetallic volcanogenic massive sulphide and epithermal gold deposits.

Farther north, near Atlin, Mitch Mihalynuk and Moira Smith completed a mapping program started in 1990. New isotopic data indicates that volcanic strata of Table Mountain are at least in part Cretaceous, not Triassic as implied by stratigraphic relationships mapped farther to the west. The team also mapped, to the south, in the Tulsequah area where the recently defined Llewellyn gold-arsenic-antimony trend and the well established Tulsequah volcanogenic massive sulphide trend form two linear, converging belts. The Maple Leaf prospect and the areas surrounding the Polaris-Taku and Tulsequah Chief mines were examined. The Llewellyn fault, a major structure important in localizing mineralization, extends through the area, but farther east than was predicted.

In central British Columbia the northern Quesnel Trough, perhaps the most active area in the province this season, is the focus of two projects. Joanne Nelson and Kim Bellefontaine extended mapping northward from the area surrounding the giant Mount Milligan alkalic copper-gold porphyry deposit. Similar lithologies continue northward, although local volcanic centers differ and produced complex stratigraphic interrelationships.

Fil Ferri and Steve Dudka are carrying out the mapping on a MDA funded project, centered near Oslinka Lake. There, accreted rocks of Quesnellia are juxtaposed with North American strata. Alkalic porphyry deposits in the accreted Mesozoic volcanic and intrusive rocks are the primary targets, but there is base metal potential in the North American rocks.

Resource Evaluation

The section is also responsible for conducting field evaluations of candidate parks and wilderness areas in advance of land-use decisions.

During the 1991 season, Bob Gaba and Pat Desjardins systematically mapped and sampled areas in the Babine Recreation area near Smithers to define mineral potential. In a larger project, Jennifer Pell and Jan Hammack mapped the geology and evaluated the mineral potential of the Kakwa area east of McBride. This area, underlain mainly by rocks of the North American craton, has potential for base metals as well as industrial minerals such as silica and magnesite.

Geographic Information System

Computer technology is increasingly presenting new opportunities and potential for resource management and mineral exploration and development. At the same time, resource evaluation and managment is becoming more complex due to the development of large and diverse geoscience databases. The Branch is striving to stay current in geoscience information management and has therefore initiated a GIS (Geographic Information System) project. This project, using Mineral Development Agreement funds, will define test projects, test hardware and software, and recommend procedures for evaluating mineral potential and developing new resource exploration techniques.

ENVIRONMENTAL GEOLOGY SECTION

Applied Geochemistry Unit

The 1991 Regional Geochemical Survey (RGS) featured the release of seven Open Files (NTS 82E, F, G, K, L, M, and J) covering more than 100 000 square kilometers of southeastern British Columbia. Increased staking activity in the eastern Rocky Mountains resulted from the release of new analytical data for gold and up to thirty-nine elements from joint federal-provincial RGS archival samples. In addition, as a joint project with the British Columbia Ministry of Environment, a water quality survey of 82G and 82J provided data on Cu, Pb, Zn, As, Cd, Hg, and sulphate in waters.

The 1991 RGS program was funded by the new Mineral Development Agreement and was conducted over the Mount Waddington (92N) map sheet. In conjunction with the Surficial Geology Unit, a drift prospecting program was carried out to develop mineral exploration guidelines for glaciated regions with thick surficial cover.

Surficial Geology Unit

Programs conducted by the Surficial Geology Unit include studies in geologic hazards, drift exploration, placer geology and surficial mapping. A joint project with the GSC investigating the neotectonics of southwestern British Columbia involved offshore coring and the study of onshore evidence of earthquakes and tsunamis. A workshop to discuss the geology and management of geologic hazards in British Columbia was held in March 1991, and public information circulars on earthquakes and landslides were prepared. Under the drift prospecting program, integrated geochemical and surficial geology studies were carried out at the Mount Milligan, Island Copper, and Kemess Cu-Au porphyry deposits. Geological investigations of gold placers in central British Columbia are ongoing. In northwestern British Columbia a new placer program was initiated, and a field conference was held in Atlin. Quaternary stratigraphic studies were conducted in the Peace River district in conjunction with landslide work, surficial geology mapping, and archaeological investigations by researchers from Memorial and Simon Fraser Universities.

Analytical Sciences Laboratory

The Analytical Sciences Laboratory provides services to the Branch and performs up to 30,000 analyses per year using XRF, AA and ICP techniques. In 1991, a "schedule of services" and a regular newsletter were introduced to better inform users of sample preparation and analytical methods, quality control, and a new user pay system. Laboratory staff continue to administer the Assayers Certification

Program and to conduct research on remedial techniques for limiting acid drainage from mine waste. Laboratory staff are also compiling Open File reports on stream water geochemistry for NTS map areas 82J and 82G, and rock geochemical data collected by Branch staff for NTS map sheet 93. A new program involves monitoring water chemistry at the abandoned Mount Washington mine and a laboratory study of ways to neutralize acid pollution.

ECONOMIC GEOLOGY SECTION

The new Economic Geology Section comprises Industrial and Metallic Minerals and Coal.

Industrial Minerals

Dan Hora continued to monitor all activities in the industrial mineral sector and provided assistance to a wide variety of clients. He coordinated studies of residual kaolin in the Georgia Basin and rhodonite near Bella Coola. The Mt. Brussilof magnesite deposit study by George Simandl was expanded to a regional study of magnesite deposits in southeastern British Columbia; the Marysville, Driftwood Creek, Red Mountain and other occurrences were examined. Their economic potential will be evaluated and a sediment-hosted magnesite model will be developed. The Branch co-hosted, with the Alberta Geological Survey, the 27th Forum on the Geology of Industrial Minerals in May, 1991, at Banff.

Coal

The Branch's shallow, coal sampling, drilling program continued under Alex Matheson's supervision in the Merrit Basin. The core provides fresh samples from poorly documented coalfields for thermal coal analysis. In the northwest part of the province Barry Ryan continued his investigations of numerous coalfields, including the Tuya River, Coal River, Little Cedar River, Seton and Telkwa. John Cunningham and Ward Kilby continued their 1:50 000 scale regional mapping of the northeast coalfield in the Chetwynd area. On Vancouver Island the mapping of the Comox and Nanaimo coalfields was completed and marked the last year of Candace Kenyon's field program in the area. David Grieve and Maria Holluszko continued their province-wide studies on coal quality, including washability, sulphur and trace elements. Coal quality data are published in the British Columbia Coal Catalog and Coal Specifications brochure.

Mineral Deposits

Gerry Ray and Ian Webster completed the final field season on their skarn project with a provincial reconnaissance program, including studies of Phoenix, Coxey, Dimac, Emerald Tungsten, Second Relief, Craigmenot, Piedmont, Cassiar area, Maid of Erin, and State of Montana skarns. The listwanite-gold project entered its second phase with field work expanded to include the Rossland, Greenwood, and Bralorne areas. From this work Chris Ash has developed a model to explain gold deposits hosted by ophiolitic ultramafic rocks and their associated listwanite alteration. A program investigating copper-gold-silver deposits, transitional between porphyry copper and high-sulphidation epithermal deposits, was started by Andre Panteleyev with reconnaissance field work on northern Vancouver Island and in northern British Columbia. Trygve Hoy continued his research in the Kimberley area as co-leader of the Geological Survey Branch - Geological Survey of Canada, Sullivan project which is studying the mine and host Aldridge succession. Mineral deposits staff were involved in completing other projects, such as Dani Alldrick's on the Unuk-Iskut Rivers and Neil Church's in the Bridge River. A successful mineral deposits short course was presented in Vancouver early in the year.

DISTRICT GEOLOGY SECTION

In 1991/92 the responsibilities of the five District Geologists and the Senior Regional Geologist continued to include:

- maintaining an up-to-date inventory of the geology, exploration trends and developments throughout the province, and reporting thereon,

- participating in the Ministry's Mine Development Review Process,

- providing input and response to land-use and integrated resource management activities by participating in committees and providing technical advice.

- providing training and assistance for prospectors and explorationists, which in 1991 included the delivery of several field conferences at Kamloops, Atlin, Fort St. James, Bronson Creek, and Galore Creek.

Although exploration activity decreased considerably in 1991, the District Geologists and the Senior Regional Geologist continued with mineral deposits studies in "hot" areas such as the Omineca and Quesnel Trough copper-gold porphyry belts, the Iskut-Stikine precious-base metal belts, and parts of the Kootenay and Okanagan regions. The District Geologists, in the first quarter of 1991, represented the Ministry at 104 public planning meetings held throughout the Province for new large protected areas: - Parks and Wilderness for the 90's.

The District Geology section also underwent significant reorganization in 1990, which included:

- promotion of Dave Lefebure from District Geologist, Smithers, to Manager of the Economic Geology Section, in Victoria,

- transfer of Andrew Legun from District Geologist, Nelson, to the Regional Mapping and Resource Evaluation Section in Victoria,

- transfer of Paul Wilton from District Geologist, Victoria, to District Geologist in Nelson,

- move of the District Geologist office for the Southwest Region from Victoria to Vancouver,

- appointment of two new District Geologists in Smithers and Vancouver.

PROSPECTOR TRAINING

The Prospectors Training Program, consisting of several basic and intermediate level courses, the Advanced Prospecting School and the advanced Petrology for Prospectors course, was continued during 1991.

The 15th annual Advanced Prospecting Course was delivered in May, 1991, to a class of 26 students. This course continues to be one of the best in Canada thanks to the efforts of coordinator James Pardy, the District Geologists and private sector specialists who teach it.

The Petrology for Prospectors course was jointly delivered with the Kamloops Exploration Group in conjunction with the Kamloops field conference that was held April 8/9, 1991. The course focuses on rock suites and rock alteration associated with various types of mineral deposits found in the province. Dr. Tom Richards was the principal instructor to a class of 20 satisfied students.

The Prospectors Grant program was suspended for the 1991/92 fiscal year due to budget restrictions.

GEOSCIENCE INFORMATION SECTION

Public Information Program

In 1991 the Geological Survey Branch established a Public Information program with a broad mandate to increase the awareness of British Columbians of the importance of geoscience in their lives. All Branch staff contribute to the program whether it be by school visits, brochures or poster displays. Program coordination is Nick Massey. James Pardy also works on the program in addition to his responsibilities for the Prospector's Training Program.

One of the main aims of the program is to improve the Branch's communication with the public. Traditionally the Branch served a very technical audience of prospectors, geologists, engineers, investors and policy makers in the mineral sector or related government agencies. This program will ensure Branch participation with other agencies, such as schools, tourism, the media, Ministry of Parks, etc. to ensure that geoscience information is disseminated to the public and special interest groups.

MINFILE

In July 1991, the Branch released version 3.0 of its free mineral inventory software program MINFILE/pc. Version 3.0 now represents a complete stand alone PC-based mineral inventory system with user friendly searching, reporting and data entry modules. The advantage of version 3.0 over earlier versions is that it allows users to modify our data, enter new data or establish new records for their own discoveries.

ALBERTA GEOLOGICAL SURVEY

The Alberta Geological Survey, a department of the Alberta Research Council, is co-managed with the Alberta Department of Energy. Our mission is to advance the economy of the province through survey and research services that are supportive of environmentally responsible management, exploration and sustainable development of the province's energy and mineral resources.

During 1991 the Alberta Geological Survey worked in four main areas: coal geology, industrial and metallic minerals, oil sands geology, and petroleum geology and basin analysis. Much of the work was jointly funded with government departments and agencies, with a small amount done under direct contract to industry or government departments.

Industrial and Metallic Minerals

The Industrial and Metallic Minerals Section investigates the mineral resources and related geology of Alberta, records and stores mineral resource data (including drill core and mineral assessment reports), answers mineral resource-related enquiries, and disseminates information of the mineral resources of the province.

1991 saw the Industrial and Metallic Minerals Section release its Mineral Deposits and Occurrences File (AMDO). The AMDO file contains mineral data, with systematic information on geological setting and resource attributes. Careful checks have been made to ensure the validity and consistency of data, the integrity of the data base, and software has been designed to facilitate selective retrieval of mineral deposit information.

The mineral types contained in the data base are classified into five major categories based on geologic origin and setting:

- chemical and biogenic sediments
- evaporites
- terrigenous clastics (fine and coarse)
- igneous emplacements
- miscellaneous

This project provides access to data in three different modes, each catering to the software and system capabilities of particular user segments.

One access mode is HyperCard, a software package supplied with Macintosh computers, on which AMDO is now fully operational. HyperCard does not require special training; a user-friendly manual describes the nature and content of the file, as well as procedures for accessing and searching AMDO.

A second access mode is IBM-PC, a standard operating tool for many organizations. Data transfer to IBM involves translation of HyperCard data into ASCII files readable by the IBM-PC software package "PC/File".

The third access mode is the VAX mainframe, on which the AMDO file is currently being developed as a relational data base using INGRESS software. This access mode will permit data to be integrated with other resource information on a provincial scale.

The IBM-PC and VAX mainframe modes are being expanded to include graphic outputs within a Geoscience Information System (GSIS) concept, to produce a mineral deposits map for the province.

1991 also saw the Mineral Core Research Facility (MCRF), the repository for all mineral core drilled in Alberta, moved to a new, more spacious facility. Another 14.5 km of core was added during the year plus the complete reference collection of Alberta Shield rocks collected by Dr. J.D. Godfrey between 1957 and 1975.

Between May 5th and 10th, Alberta and British Columbia co-hosted the successful 27th Forum on the Geology of Industrial Minerals. Approximately 200 delegates from across North America and Europe met in Banff to survey new developments in Alberta's varied and valuable industrial minerals industry. Technical sessions, field trips and plant tours highlighted the scope and diversity of Alberta and B.C.'s resources.

1991 saw the publiction of an Economic Geology Report (Number 7) on Alberta clays, "The Ceramic Potential of Alberta Clays and Shales" by D.W. Scafe. The report provides new data on nearly every geological formation in the province, highlights the promising units for further testing, and outlines the ceramic uses to which they could be put.

Coal Geology

Exploration, development, marketability, and sound land-use policies related to coal all benefit from the extensive data collected by the Alberta Geological Survey. In-house expertise in sedimentology, stratigraphy, structural geology, and coal quality offer solid, broad-based capabilities to the coal sector.

One of the highlights of the Coal Geology Section in 1991 has been the completion of its regional coal bed methane (CBM) program. The program was focused on more clearly defining the CBM potential of the Alberta basin, by mapping the distribution and thermal maturity of several coal zones in both the plains and foothills. The study was supported by funding from 14 companies, the Alberta Department of Energy and CANMET. A second phase of CBM research through a research cooperative of interested government and industry players is under development.

The Coal Section also continued its coal compilation mapping project during the period of this report. Through the application of geographic information systems technology the project has produced an additional four regional coal maps of the foothills region of west-central Alberta. These four maps are included in a collection that will ultimately see 18 1:50 000 map sheets produced. Available in electronic or hard copy formats, the final product can be customized to suit the needs of individual clients and can include as much or as little of the available data as desired.

Oil Sands Geology

During the year, the Oil Sands Geology Section had three broad objectives: (1) to continue the long term, regional resource characterization and assessment studies of the major oil sands deposits; (2) to develop and evaluate techniques for the detailed quantitative characterization of oil sands reservoirs;

and (3) to provide fundamental geological support to the Alberta Oil Sands Technology and Research Authority's (AOSTRA) Underground Test Facility (UTF).

Oil Sands Geology studies comprise two research programs, and the largest, the joint oil sands geology program, is funded on an equal basis by the Alberta Research Council and AOSTRA. Within this program there are two major technical projects: resource characterization, and reservoir analysis. The resource characterization project team is studying the McMurray/Wabiskaw stratigraphic interval in the Athabasca area. Reports and publications have recently been produced on the central, southern, and western parts of the Athabasca area. In reservoir analysis, work on quantifying and scaling up reservoir properties in the Provost Upper Mannville B Pool has been synthesized and finalized.

A highlight of 1991 was publication of the Athabasca Central and West reports from the Resource Characterization project in the AOSTRA Technical Publication series. Both previously completed and future client reports from resource characterization and reservoir analysis will be published in this series to ensure widespread dissemination of the results of the joint oil sands geology program.

The second major research program, funded entirely by AOSTRA, is the strategic geology program. Geological support for AOSTRA's Underground Test Facility, which provides a unique opportunity for comparison of reservoir characteristics and the response to thermal stimulation, was the main priority in 1991. Geological support, which included core work and the correlation and mapping of reservoir units, was provided for the development of Phase B. A lease wide study of the underlying Devonian limestone was carried out to aid the geotechnical engineers in future planning for tunnels. The development of a model, based on Phase A data, to characterize the distribution of facies and petrophysical properties in the reservoir was initiated. Also, a report was completed on the applicability of the UTF technology to other parts of the McMurray Deposit in the Athabasca area.

Petrology Geology and Basin Analysis

The objective of the Petroleum Geology and Basin Analysis Section is to establish a systematic and integrated framework of the Alberta subsurface on a regional scale, which will serve as a basis for (1) evaluation of the potential of the Alberta basin for energy and mineral resources, (2) exploration and development of energy and mineral resources, and (3) development of economic and environmental policy. This objective is attained on a continuous basis by means of data acquisition; implementation of specialized data bases; data interpretation, analysis, and synthesis; and compilation and publication of various maps, reports, and scientific papers.

The main activity during the period covered by this report involved the large-scale regional description and analysis of the Western Canada Sedimentary Basin. Work continued on the Geological Atlas of the Western Canada Sedimentary Basin. Electronic data processing of large data bases and the management and compilation of the geological atlas are being carried out by this section, with the help of more than 100 contributors from industry, academia, and government organizations.

The Alberta Geological Survey has also embarked on a regional-scale hydrogeological study aimed at supporting sustainable development of the province's bitumen resources. The program, focussed on the Athabasca Oil Sands Area in northeast Alberta (Twp. 70-103, W 4 Mer), will provide an information base for local-scale environmental assessment of the effects of deep disposal of residual water.

Currently in the Athabasca area residual waters from both mining and in-situ methods of oil extraction represent a significant environmental challenge. As development continues and tailing ponds reach full capacity, consideration is being given to injection of produced water from mining operations. In addition, deep injection of residual water is an option for in-situ operations including underground extraction sites such as the Underground Test Facility of the Alberta Oil Sands Technology and Research Authority, near Fort McMurray.

Phase 1 of the program, completed in March 1991, assessed the complex geology and hydrostratigraphy of the study area resulting from various salt dissolution and erosional events characteristic of the region.

Phase 2 of the program is now underway and is focussed on the analysis of the hydrogeological regime of formation waters. This portion of the program is being conducted using chemical analyses of formation waters, an estimated 2500 drillstem tests and over 400,000 core analyses to interpret the flow regime of formation waters. A report on this component of the program is scheduled for the spring of 1992. The Alberta Geological Survey is carrying out this program in cooperation with Environment Canada and the Alberta Oil Sands Technology and Research Authority.

Saskatchewan Department of Energy and Mines
Geology and Mines Division
Geoscience Activities of the Saskatchewan Geological Survey

The geoscience activities of the Geology and Mines Division (Saskatchewan Geological Survey), are undertaken by four branches: Precambrian Geology, Mineral Development, Petroleum Geology and Sedimentary Geodata. Advice on the Geological Survey's program is provided by the Saskatchewan Geological Liaison Committee comprising representatives from industry, the universities in Saskatchewan, the Geological Survey of Canada and the Saskatchewan Research Council. Liaison with the Geological Survey of Canada has been strengthened during the past year with the resumption of a federal A-base bedrock mapping-type project, and discussions leading up to the commencement of a pilot National Geoscience Mapping (NATMAP) project.

1. Mineral Exploration in Province

Geoscientific activities continue to be largely focussed towards the promotion of mineral exploration activity in the province. Although uranium and base metal exploration continues at a similar low level to last year, gold and precious metal exploration is significantly down. Apart from the continuing interest in deep Paleozoic oil in the Minton area, petroleum and gas drilling activity has also taken further reductions. Industrial mineral activity, including potash, is soft. The diamond exploration scene is brighter, with the announcement by Uranerz-Cameco of the discovery of the 70 kimberlite pipes of Cretaceous age in three clusters in the Fort a la Corne area. According to Uranerz, preliminary investigation of 17 pipes has revealed the presence of sub-economic macro diamonds.

2. New Mineral Development Agreement

Operational funds of the Saskatchewan Geological Survey have been provided in recent years almost entirely through federal-provincial mineral development agreements. A new five-year Canada-Saskatchewan Partnership Agreement on Mineral Development ("MDA2") was signed in May 1991, retroactive to April 1, 1990. This agreement, which is part of a Western Diversification package for the four western provinces, has a total funding over five years of $10 million, equally cost-shared between Canada and Saskatchewan on a parallel delivery basis. Expenditures incurred in 1990-91 under the Saskatchewan Mineral Industry Diversification Program are eligible as the provincial contribution in year one of the agreement. A Summer Student Employment Program (SSEP) brought total project operational funding in both fiscal years 1990-91 and 1991-92 to about $1.2 million. The federal part of the program is being implemented in the four years 1991-95, with provision for wind up and final reporting in fiscal year 1995-96. MDA2 is primarily oriented to geoscience with a total of $7.35 million allocated to geological mapping, geophysical and geochemical surveys, mineral deposit investigations and related studies. Other components of the agreement include research and development in mineral processing, market and other economic studies, and public information.

In 1991-92, approximately 60 percent of provincial MDA2 funds were directed to northern geoscience field projects, 20 percent to southern geoscience, and the remainder to compilation and database projects as well as prospector training and public information. The program has involved permanent and contract staff, as well as contracts and joint studies mainly with the universities of Saskatchewan and Regina, and the Saskatchewan Research Council, as well as joint projects with other universities.

3. Northern Geoscience Program

In the northern program, emphasis switched in 1990-91 to the southeastern part of the Precambrian Shield around Flin Flon, Hanson Lake and portions of the Glennie and Kisseynew Domains. In this region, revision geological mapping and geochemical studies are being carried out in an attempt to gain a better understanding of the geological setting and control of gold and particularly base metal deposits, so as to identify areas worthy of detailed exploration. In order to concentrate on the southeast, the reconnaissance bedrock mapping of the region north of Lake Athabasca, which was revived in 1989-90 was abandoned. Although the Saskatchewan Geological Survey did no work in this area during the past year, the Geological Survey of Canada completed remapping and tectono-structural studies in summer 1991 in the Tantato Domain immediately north of Stony Rapids, and the University of Saskatchewan also undertook a new isotopic study of the Mine Granites of the Beaverlodge area.

An important feature of the 1991 geoscience program is a higher degree of integration of federal and provincial projects than had been attempted in previous federal-provincial parallel delivery programs. The main example of this integrated and holistic approach is the joint superproject in the Flin Flon-Hanson Lake area involving the province's Project Seagull and the broader GSC Shield Margin Project of the National Geoscience Mapping Program (NATMAP). The fundamental objective here is to provide an integrated and diverse dataset to encourage mineral exploration particularly for base metals both along the Shield edge and further south in Precambrian basement lying beneath Paleozoic formations. This involves data acquisition in digital format and GIS-generated bedrock geological maps, and will serve as a useful test case for further development of computerized mapping in the provincial survey. The multidisciplinary nature of the Sheid Margin Project is being enhanced by the Lithoprobe Transect of the Trans-Hudson Orogen which crosses the Project Seagull area.

The main provincial activity in the southeastern part of the Shield continues to be revision bedrock mapping at 1:20,000 or 1:12,500 scale. This mapping is being complemented by P-T petrological studies, lithogeochemistry, geochronology and isotope geology. The Survey has also funded a number of smaller mineral deposit and metallogenic studies.

Two resident geologists are headquartered in La Ronge, while the Creighton office continued to be operated on a part-time basis. The Mineralized Core Collection in La Ronge acquired core mainly from gold and base metal exploration sites. The Prospectors' School continues to offer a six week course to students supported under the Canada-Saskatchewan Northern Employment Development Subsidiary Agreement.

Northern projects initiated or ongoing in 1991 are indicated on the attached figure and caption. This list includes projects funded to other agencies by Saskatchewan Energy and Mines, and also projects which were reported in the Saskatchewan Geological Survey Summary of Investigations 1991 by other agencies funded elsewhere. These include contributions from the Geological Survey of Canada, Saskatchewan Research Council and the geology departments of the universities of Regina and Saskatchewan.

4. Southern Geoscience Program

In the south, a number of industrial minerals projects started before MDA2 are being continued under MDA2 funding. These include the winding down of studies on building stones, and a lignite reserve estimates study which was handed over for completion by the ISPG, Calgary. New studies initiated during the year include work on clays, compilation of a gravity map of southern Saskatchewan, and a joint study of mineralized brine with the GSC involving over 14,000 analyses.

Investigations into the regional distribution of kimberlites and their geophysical and geochemical signatures were continued. The "Phanerozoid Anomalies" project comprises a petrographic/isotope study of core from deep basement in the Phanerozoic sedimentary basin, and the checking of potential kimberlite sites in the Shield area. Several southern anomalies were ground checked by indicator minerals and magnetic surveys, with favourable results.

During the year, a consortium comprising the Geological Survey of Canada, Saskatchewan Geological Survey and several industry members initiated a joint program of aeromagnetic surveys intended to complete coverage of the Phanerozoic sedimentary basin in four years. The new aeromagnetic data is expected to be invaluable in kimberlite prospecting as well as for studies on potash and hydrocarbons. The Petroleum Geology branch completed its contribution to the new Geological Atlas of Western Canada, which is due out by December 1991, and was also involved in the Williston Basin Symposium held October, 1991. A significant part of the branch's activity is devoted to picking well logs and consultations to industry geologists. Stratigraphic information from licensed wells was processed and added to the Well Information System. Stratigraphic studies in progress are indicated in Table 1.

Several workshops on introductory geology were arranged for school groups, and due to a change in school curricula the dramatically increased demand for sets of typical Saskatchewan rocks and minerals produced in the branch has not yet abated.

5. Data Files and Computerization

The program of database and computer enhancement commenced in the previous year was continued. Portable computers were provided for most field geologists, particularly those involved in Project Seagull where the data is being compiled in a GIS digital form in collaboration with the GSC. Bedrock geological maps produced for the 1991 Summary of Investigations report were produced for the first time in most cases using FieldLog software provided by the Ontario Geological Survey. A pilot study into the processing and enhancement of geophysical and other regional numeric data using RTI/CAD software was completed for parts of the Glennie Domain gold belts. The computerized Well Information File (oil and gas wells) is available on a monthly updated CDI-ROM disk through PubCo in Calgary. A new Industrial Minerals data file was initiated. Several database files are being open filed and made available in microcomputer formats. These include the Assessment Work Catalogs, Mineralized Core Collection Inventory, Mineral Deposits Inventory, Saskatchewan Precambrian Bibliography, and the Geochronology File.

Table 1. Projects Supported by Petroleum Geology Branch in 1991.

No.	Researcher	Title	Area	Status
PG861	Haidl, F.M.	Geology of the Silurian Interlake Formation, Saskatchewan	Townships 1 to 60 inclusive	Ongoing in Oct. 1991
PG862	Gilboy, C.F.	Geology of the Upper Colorado Group and the Milk River Formation (Upper Cretaceous), Southwestern Saskatchewan	Ranges 21 to 29W3 inclusive; Townships 1 to 2 inclusive	Ongoing in Oct. 1991
PG871	Christopher, J.E.	Geology of the Mannville Group (Lower Cretaceous), Saskatchewan	Townships 1 to 100 inclusive	Contract. Writing up Oct. 1991
PG872	Kreis, L.K.	Stratigraphy of the Jurassic System in the Wapelia-Moosomin Area, Southeastern Saskatchewan	Ranges 30W1 to 2W2 inclusive; Townships 12 to 17 inclusive	Study completed Mar.1990 as Master's Thesis; successfully defended Apr.90; report published Apr. 91
PG901	Gilboy, C.F.	Regional Cross-sections of Strata above the Mannville Group (Lower Cretaceous) in Saskatchewan	Townships 1 to 25 inclusive	Ongoing Oct. 1991
PG902	Leckie, D.A., Gilboy, C.F. *et al.*	Colorado/Alberta Group Strata of the Western Canada Sedimentary Basin	Townships 1 to 65 inclusive (in Saskatchewan)	Completed and presented at 'Basin Perspectives' Meeting, Calgary, May 1990; expanded for incorporation into 'Geological Atlas of the Western Canada Sedimentary Basin' in late 1991
PG903	Slind, O.L., Paterson, D.F. *et al.*	Middle Cambrian-Lower Ordovician Strata of the Western Canada Sedimentary Basin	Townships 1 to 70 inclusive (in Saskatchewan)	Completed and presented at 'Basin Perspectives' Meeting, Calgary, May 1990; expanded for incorporation into into 'Geological Atlas of the Western Canada Sedimentary Basin' in late 1991
PG904	Norford, B.S., Haidl, F.M., Paterson, D.F., *et al.*	Middle Ordovician-Silurian Strata of the Western Canada Sedimentary Basin	Townships 1 to 66 inclusive (in Saskatchewan)	Completed and presented at 'Basin Perspectives' Meeting, Calgary, May 1990; expanded for incorporation into 'Geological Atlas of the Western Canada Sedimentary Basin' in late 1991
PG906	Kreis, L.K. (and Gent, M.)	Subsurface Brines in Southern Saskatchewan	Townships 1 to 80 inclusive	Poster display at S.E.M. Open House 1990. Open File Report in prep., Oct. 1991; paper prepared for presentation and publishing at 6th Int. Williston Basin Symp. Oct. 1991
PG911	Haidl, F.M.	Note on the Ordovician-Silurian Boundary in Southeastern Saskatchewan	Townships 1 to 20 inclusive; Ranges 30W1 to 20W2 inclusive	Paper for Summary of Investigations, Nov. 1991
PG912	Gilboy, C.F., Nambudiri, E.M.V.	Note of Preliminary Palynological Investigations of Upper Cretaceous Strata, Southwestern Saskatchewan	Townships 2 to 16 inclusive; Ranges 28W3 to 30W3 inclusive	Paper for Summary of Investigations, Nov. 1991
UR891	Yurkowski, M.	Pore Geometry Reservoir Model Study for the Upper Winnipegosis Member (Devonian) in Southwest Saskatchewan	Ranges 30W1 to 12W2 inclusive Townships 1 to 10 inclusive	Ongoing Master's Study at University of Reginal in Oct. 1991; progress report May 1991

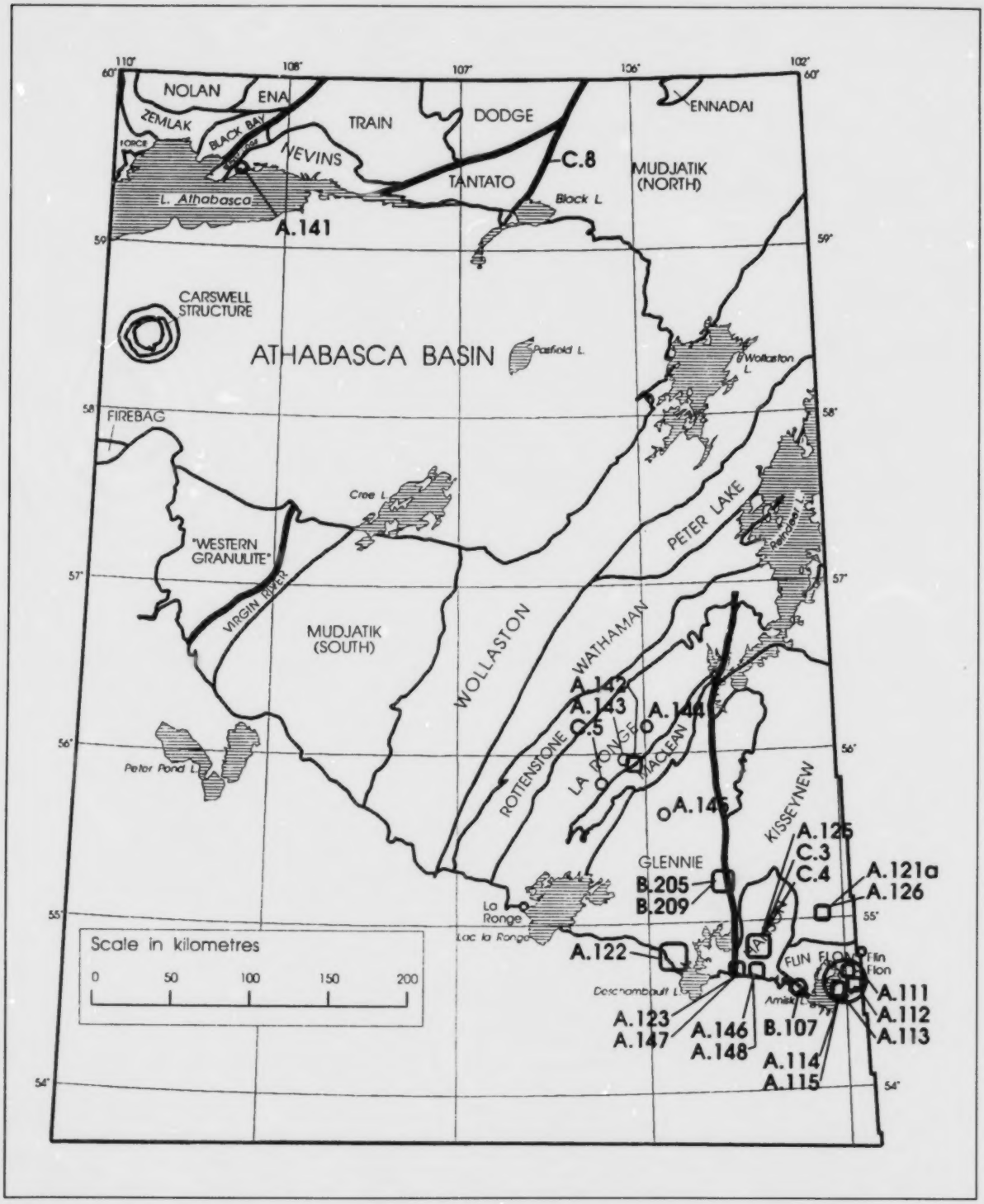


Figure 1. Location of projects or reports in hand 1991-92 in northern Saskatchewan (excluding compilation maps). Numbers on map refer to the project number of the Canada-Saskatchewan Partnership Agreement on Mineral Development program (PAMD or generally known as MDA2) listed in the first column opposite. The base map shows in abbreviated form the location of the main lithostructural domains in northern Sasatchewan.

Proj. No.	Data No.*	Short Title of Project/ Project(s) Leader(s)	
Outputs from PAMD 1990-5 Projects in 1991-92:			
A.111	9112	Revision Bedrock Mapping, Bootleg Lake-Birch Lake Area *Thomas, D.J.*	(F,M)
A.112	9123	Revision Bedrock Mapping, Mystic-Kaminis Lakes Area *Reilly, B.A.*	(F,M)
A.113	9130	Revision Bedrock Mapping, Table Lake Area *Slimmon, W.L.*	(F,M)
A.114	9137	Lithogeochemical Studies, East Amisk Lake Area *Watters, B.R.*	(F,C)
A.115	9150	Shield Margin Project (NAMAP), Project Seagull and GIS *Lucas, S., Macdonald, R., Thomas, D.J. & Czornobay, B.*	(G)
A.121a	9147	Revision Bedrock Mapping, Wildnest-Attitti Area *Ashton, K.E. & Leclair, A.*	(F,M)
A.121b	9147	Metamorphic P-T Investigations, Kisseynew and Flin Flon Domains *Diegel, S. et al.*	(W,C)
A.122	9122	Revision Bedrock Mapping, Deschhambault-Oskikebuk Lakes Area *Delaney, G.D.*	(F,M)
A.123	9117	Revision Bedrock Mapping, Southeast Arm,	
A.147	9106	Deschambault Lake-Northern Lights Area *Lewry, J.F. & Sibbald, T.I.I.*	(F,M,C)
A.124	9136	Glennie-Kisseynew P-T Study 1991 *Perkins, D.*	(F,C,W)
A.125	9151	Metamorphic P-T Studies, Jan Lake Area *Abbas-Hasanie, Syed et al.*	(F,C)
A.126	9115	Lithogeochemical Studies, Wildnest-Attitti Lakes Area *Parslow, G.R.*	(F,C)
A.131	9128	U-Pb Geochronological Investigations in Northern Saskatchewan: Preliminary Results by ROM in 1991-92 *Heeman, L.M. et al.*	(F,C,W)
A.132	9104	Review of Recent Isotopic/Geochronological Work *Bickford, M.E. & Lewry, J.F.*	(F,C,W)
A.141	9134	Age of the Mine Granites, Goldfields Area *O'Hanley, D. et al.*	(F?,C)
A.142	9129	Deformation in the Star-McLennan Lakes Area *Chei, H. & Roberts, R.G.*	(F,C)
A.143	9138	Alteration Haloes, Star and Island Lake Plutons *Appleyard, E.C.*	(F,C)
A.144	9135	Field Observations of the Broken Hammer Gold Showing and the NIKO Gold Showing *Schwann, P.*	(F)
A.145	9149	Structural Controls and Geochemical Character, Seabee Gold Mine *Schultz, D.J. et al.*	(F?,C)
A.146	9152	Mineralization and Associated Alteration in the Hanson Lake Area *Maxeiner, R.O. & Watters, B.R.*	(F,C)
A.148	9133	Rare Element Pegmatites in the Hanson Lake Pegmatite Field *MacDougall, D.G.*	(F,M)
A.321	9105	Mineralized Core Collection *Gracie, A.J.*	(W)
Outputs from PAMD 1990-5 in 1990-91 and extension:			
B.107	9037	Geochemistry and Tectonic Setting of Metabasaltic Rocks from the Snake Rapids Area *Watters, B.R. & Ashton, K.*	(C)
B.205	9040	Geological Relationships in the Wood Lake Area, Tabbernor Fault Zone *Wilcox, K.H.*	(F,G)
B.209	9048	Reconnaissance Petrographic and Isotopic Study of the Fluid History in the Tabbernor Fault Zone *Field, M.P. & Kerrich, R.*	(C)
Projects not funded by the Saskatchewan Geological Survey, but papers contributed to Summary of Investigations 1991:			
C.1		The Lithoprobe Trans-Hudson Transect (THOT): Status Report *J.F. Lewry and Z. Hajnal*	(W)
C.2		Detrital Zircons from Missi Metasedimentary Rocks, Flin Flon Basin: Constraints on Age and Provenance *K.M. Ansdell, T.K. Kyser, M.R. Stauffer and G.Edwards*	
C.3		Chemical Signatures of Igneous and Metasedimentary Rocks from the Pelican Slide Area: Implications for their Sources and Tectonic environments *M. Sun, M.R. Stauffer, J.F. Lewry, G. Edwards, R. Kerrich and T.K. Kyser*	
C.4		Origin and Kinematic History of Highly Strained Gneisses in the Eastern Jan Lake Area *Shi Rupan and J.F. Lewry*	(F,M)
C.5		Petrography, Fluid Inclusions and Stable Isotope Data from the Bakos Lode Gold Deposit *M. Fayek, T.K. Kyser and R.T. Kusmirsky*	
C.6		Mineral Parageneses, Fluid Characteristics and Radiogenic Isotope Data from the Proterozoic Gold Zone, La Ronge Domain *F. Hyrdy, T.K. Kyser and R.T. Kusmirsky*	
C.7		Tourmaline, Phosphate Minerals, Zircon and Pitchblende in the Athabasca Group: Maw Zone and McArthur River areas *D. Quirt, T. Kotzer and T.K. Kyser*	
C.8		The East Athabasca Mylonite Zone: An Archean Segment of the Snowbird Tectonic Zone *S. Kanmer, C. Kopf & M. Darrach*	

* - Database Number (formerly project number, used for samples, etc.
F - Field component in 1991
W - Project covered wide area (not shown on map)
C - Contract project in 1991
M - Map(s) or chart(s) in accompanying package
G - Federal (Geological Survey of Canada) component

MANITOBA DEPARTMENT OF MINES AND ENERGY

GEOLOGICAL SERVICES BRANCH

General

Fiscal constraints limited the scope and scale of programming conducted by the Geological Services Branch (GSB) during 1991. The reduced level of field operations was further aggravated by delays in signing the new Mineral Development Agreement with Energy, Mines and Resources, Canada.

The new Partnership Agreement on Mineral Development (PAMD) was eventually signed on June 28th by Canada, and Manitoba. Under this Agreement, a total of $10 million dollars of federal and provincial minerals programming will be directed in support of the minerals industry, during the period 1990–1995. The federal funding is provided through the Western Diversification Office. As was the case with the earlier (1984–1989) Agreement, programming is to be delivered in parallel using the combined resources of the federal and provincial departments of energy, mines (and resources), with efforts being directed in support of the exploration, and development sectors of the industry as well as projects related to marketing, promotion and public information.

The consolidation resulting from the fiscal constraints was offset to some extent by internal restructuring of the Department, and the Branch, and by the introduction of expanded services in Flin Flon, and plans for a new regional office in Thompson.

Geological Survey field programs in general, were strengthened by additional federal contributions through both EXTECH (the Exploration Science and Technology initiative), and the NATMAP (National Mapping) Shield Margin program, the latter being the first of a new generation of co-operative programs with the Geological Survey of Canada (GSC), designed to elevate the profile of geological mapping across Canada. The Shield Margin project (NASMAP) will bring together the combined resources of the Manitoba and Saskatchewan geological surveys, and the GSC, in upgrading the geoscientific data base of the important copper and zinc producing Hanson–Flin Flon and Snow Lake Mining District over the next five-year period. The main objective will be to develop a broad array of 1:100 000 scale geological, geochemical and geophysical data files and maps for the region, thereby establishing the first minerals-oriented GIS in the province. Other extremely significant advances in the north-central sector of the Province, were realized through completion of regional and high-resolution seismic profiles across the Thompson nickel belt, and regional seismic profiles from the Churchill–Superior boundary into Saskatchewan, including north-trending crosslines up to Snow Lake, and across the southern margin of the Kisseynew gneissic belt. These geophysical surveys represent the first stage in a major 5-year multidisciplinary study of the Trans-Hudson Orogen in Manitoba and Saskatchewan, conducted under the aegis of Canada's renowned LITHOPROBE initiative.

Manitoba and Canada also co-operated in mounting new aeromagnetic surveys in the Dawson Bay region, a multi-year program that will eventually complete magnetic survey coverage for the entire province, with principal focus being in the southwest region, from The Pas to the 49th parallel.

In addition to mounting new field surveys, the GSB also continued to provide input to the new *Atlas of the Western Canada Sedimentary Basin*, provided an initial outline of areas for consideration under the World Wildlife Federation's Endangered Spaces program, and sponsored support for the Mineralogical Society of Manitoba's Minerals Symposium held in Winnipeg, August 29 to September 1.

The ongoing definition of Manitoba's karst heritage in the Interlake region was again assisted by contributions from members of the Speleological Society of Manitoba. An atlas of these unique and little-known features is now well advanced, with publication scheduled for early 1992.

The GSB continued computerization of its data collection, processing and publication functions, and for the first time released an electronic data base of raw data stemming from the 1985–1989 investigations

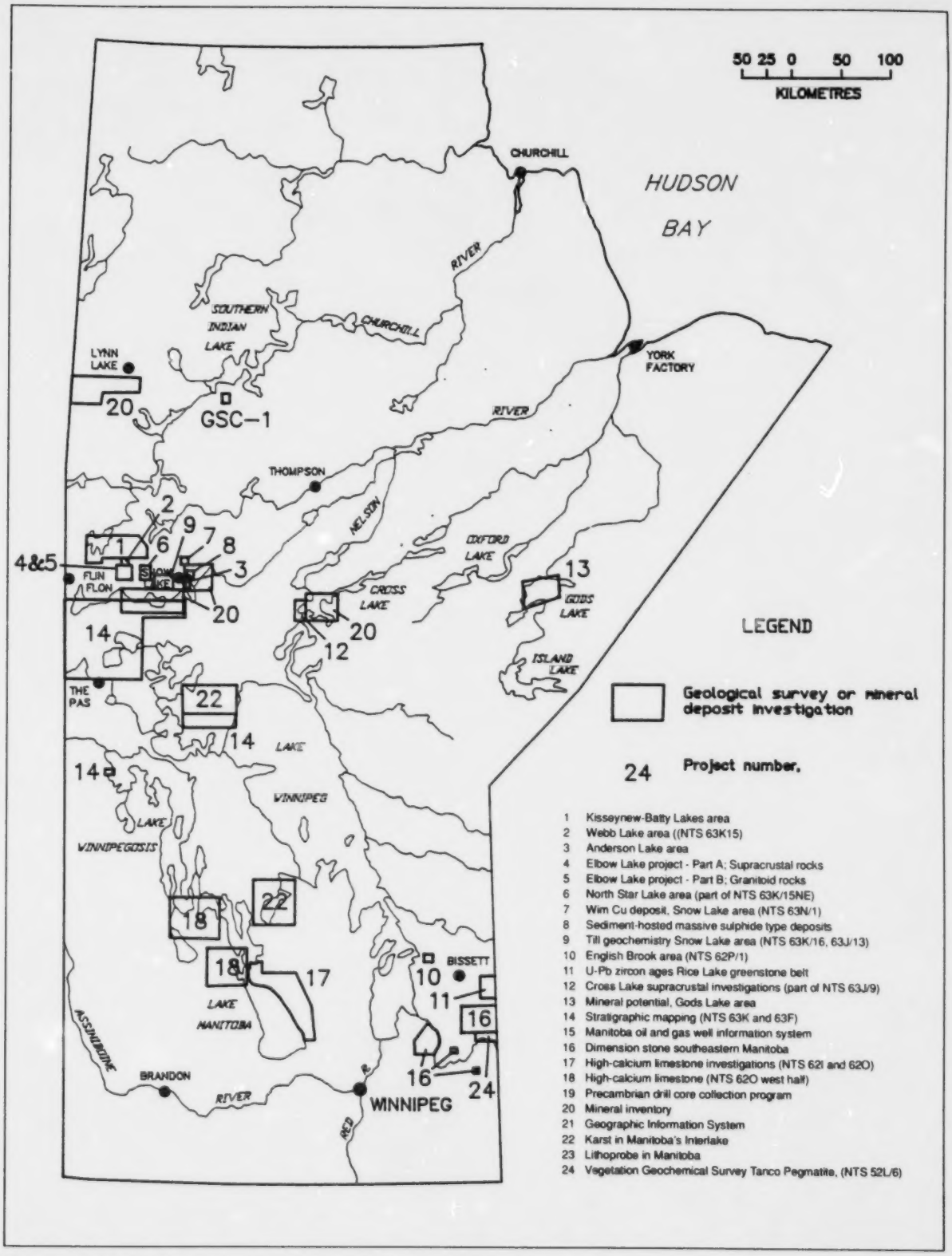

50 25 0 50 100
KILOMETRES
HUDSON BAY
CHURCHILL
YORK FACTORY
LYNN LAKE
SOUTHERN INDIAN LAKE
CHURCHILL RIVER
GSC–1
THOMPSON
NELSON RIVER
OXFORD LAKE
GODS LAKE
CROSS LAKE
ISLAND LAKE
FLIN FLON
SNOW LAKE
THE PAS
LAKE WINNIPEG
LAKE WINNIPEGOSIS
LAKE MANITOBA
ASSINIBOINE RIVER
BRANDON
BISSETT
WINNIPEG
RED R.
LEGEND
Geological survey or mineral deposit investigation
24 Project number.
1 Kisseynew-Batty Lakes area
2 Webb Lake area ((NTS 63K15)
3 Anderson Lake area
4 Elbow Lake project - Part A; Supracrustal rocks
5 Elbow Lake project - Part B; Granitoid rocks
6 North Star Lake area (part of NTS 63K/15NE)
7 Wim Cu deposit, Snow Lake area (NTS 63N/1)
8 Sediment-hosted massive sulphide type deposits
9 Till geochemistry Snow Lake area (NTS 63K/16, 63J/13)
10 English Brook area (NTS 62P/1)
11 U-Pb zircon ages Rice Lake greenstone belt
12 Cross Lake supracrustal investigations (part of NTS 63J/9)
13 Mineral potential, Gods Lake area
14 Stratigraphic mapping (NTS 63K and 63F)
15 Manitoba oil and gas well information system
16 Dimension stone southeastern Manitoba
17 High-calcium limestone investigations (NTS 62I and 62O)
18 High-calcium limestone (NTS 62O west half)
19 Precambrian drill core collection program
20 Mineral inventory
21 Geographic Information System
22 Karst in Manitoba's Interlake
23 Lithoprobe in Manitoba
24 Vegetation Geochemical Survey Tanco Pegmatite, (NTS 52L/6)

Figure 1. Manitoba Geological Survey projects, 1991.

in the Lake Athapapuskow region. An more ambitious project, currently underway under NASMAP, aims to produce coloured preliminary maps for distribution at the GSB's Mineral Activities Forum in November, based on information collected in the Elbow Lake region this summer.

Field workshops were conducted in the La Ronge and Glennie Lake Domain by the Friends of the Reindeer Zone, and in the Thompson–Cross Lake region by the Friends of the Nickel Belt. The latter workshop was extended to include a 2-day demonstration of the geology of the Cross Lake area, for the benefit of representatives from the Cross Lake Indian Band. Shorter tours and field demonstrations (8) were given to several company geologists wanting an introduction to the main mining camps, and/or specific aspects of the province's industrial mineral deposits.

Core retrieval programs continued at a low level throughout the province; a new core storage facility was opened on the old Centennial Mine site, specifically to receive exploration drill-core from the Flin Flon region.

GSB geologists attended technical meetings at Calgary, Regina, Saskatoon, Toronto and Fredericton, giving presentations highlighting the province's geology and mineral investment potential. Three new reports were issued in the Mineral Deposit series, as well as a new 1:250 000 scale bedrock compilation map covering the Churchill–Superior boundary in the Split Lake region. The volume covering the 1987 Trans-Hudson Orogen Symposium in Saskatoon was finally published this year; it contains several benchmark papers authored by Branch geologists.

A total of 110 mineral inventory cards were either compiled or updated. The Manitoba Oil and Gas Well Information System (MOGWIS) is now in the design and implementation phases (Phase II and III), with data verification (Phase IV) being well advanced.

Regrettably, co-operative research with staff of the University of Manitoba, and with researchers in other Canadian universities, was severely limited by the reduced resources available to the Branch, and in most instances was limited to exchange of analytical expertise or laboratory facilities.

The format of the annual Open House is to be expanded this November, with several talks to be given by representatives from the mineral industry. The highly popular "core shack" is to be expanded, and the meeting will kick off with a workshop exploring the possibility of initiating cost-shared, joint government-industry airborne geophysical surveys in the Shield margin region.

FIELD ACTIVITIES: District Summaries

The provincial field program, during the summer of 1991, represented a scaled-down version of what had been planned as the first year of a 4-year cycle, coinciding with the initiation of the new federal–provincial partnership agreement on mineral development. Sixteen students were employed in support of the activities; however, many projects were of limited duration, leaving more time for data analysis and computer processing in Winnipeg.

Priority was given to upgrading the geological data base for the region feeding the Flin Flon smelter. Activities were, therefore, focussed within and adjacent to the Flin Flon–Snow Lake Mining District. Fieldwork in the Lynn Lake region was completed during the 1984–1990 period, and emphasis is now being given to compiling reports and maps stemming from these field investigations.

Recognizing the need to intensify efforts as much as possible around Flin Flon and Snow Lake, this region was chosen as the target for the new GSC Exploration, Science and Technology initiative (EXTECH), and the new NASMAP Shield Margin initiative, entailing contributions from the GSC as well as the provincial Surveys in Manitoba and Saskatchewan. EXTECH investigations were focussed at Ruttan, and in the Snow Lake area, whereas provincial mapping and deposit documentation concentrated on areas around Elbow Lake, North Star Lake and Snow Lake, where extensive new exposures were created by the 1989 forest fires.

Elsewhere in the province, a start was made in the documentation of mineral occurrences in the northern Superior Province. New exposures in the English Brook (Wanipigow) area (also resulting from the 1989 forest fires) were mapped in detail. Industrial mineral investigations concentrated on defining areas of high-calcium limestone in the region centered on The Narrows of Lake Manitoba, high purity dolomite in the Interlake region, and granite dimension stone in southeast Manitoba.

Thirty-three holes were drilled during the summer, 11 being for combined stratigraphic and basement information in the Interlake region (882.6 m total), and 22 (483 m total) for commodity assessments in the Narrows and Inwood areas.

Flin Flon–Snow Lake District

Geological mapping, along the transition zone between the Flin Flon greenstone belt and the Kisseynew Domain, focussed on the structural and stratigraphic relations within this critical tectonic zone. Work by the GSB, the University of New Brunswick and the GSC found additional zones of iron and magnesium hydrothermal alteration north of the main greenstone terrain, and suggested that Missi-age volcanism is also more widespread than previously recognized.

1:20 000 scale mapping of the supracrustal rocks at the south end of Webb Lake confirmed the structural setting as a steep, south-dipping homocline cut by north-trending shear zones, one of which, the Webb Lake shear zone, exhibits sinistral movement. Mineralization appears to be both synvolcanic VMS type, and later pyritic quartz veins emplaced within the shear zones.

Mapping by the GSC and the GSB, at 1:5 000 scale, in the Anderson Lake area covered most of the economically significant base metal deposits in this region. The stratigraphic settings of the mineralization are now accurately delineated, and a clear temporal relationship can be demonstrated between the mineralization and coeval felsic volcanism and subvolcanic intrusions. The structural setting of the region is complex, and major displacement zones appear to have had a long and complicated history of reworking.

Geological mapping of supracrustal and plutonic rocks at Elbow Lake, at 1:15 840 scale, has been greatly facilitated by the creation of new exposures resulting from the 1989 forest fires. Detailed documentation of the rock types, together with preliminary geochemical results, seems to confirm the existence of three volcanic suites with distinct arc, back-arc and transitional chemistries in this region. The nature and extent of the Elbow Lake shear zone is now better defined, as is its regional extent, and its protracted history of development with several periods of syndeformational dyke emplacement. Most of the gold occurrences in this region appear to be associated with the Elbow Lake shear zone or related conjugate structures, and relatively late faults. It is still too early to explain the relative paucity of base metal deposits in this region; however, current thinking is that this may be related to the geochemistry of the associated volcanic rocks, which differs from that of the base-metal-rich arc assemblages at Flin Flon and Snow lake.

Geological mapping, at 1:5 000 scale, was conducted in the nearby North Star Lake region, which was also burned during the 1989 fires. The present studies are designed to provide a detailed geological framework for evaluating the region's mineral deposits and exploration potential. Volcanic assemblages include a wide range of felsic and mafic volcanic rocks, with local evidence of hydrothermal alteration associated with altered rhyolite flows, tuffaceous rocks and chemical sediments. The region appears to have been subjected to three periods of folding, as well as three ages of faulting. One of the most distinctive structural elements is a penetrative foliation that is axial planar to the F_1 isoclinal folds.

A brief study of the Wim deposit concluded that the mineralization ranges from disseminated to 100% sulphide, and represents a massive-sulphide-type with a well-developed alteration conduit. Rock types similar to the host rocks are widespread around the margins of the Herblet Lake gneiss dome complex, providing numerous new targets for base metal exploration.

Examination of the sediment-hosted Bur and Kobar–Ruby deposits emphasized the difference in environments of deposition between these deposits and the rhyolite-associated volcanogenic massive sulphides that are more typical of this region. Recommendations suggest that exploration strategies be extended to include the search for similar deposits to the northeast.

Regional till sampling was resumed in the Snow Lake area to expand on sampling undertaken in 1990. Some 159 till samples were collected from 145 locations, along with 145 samples of humus.

Southeast Manitoba District:

The workplan for the southeastern sector of the province contains a broad range of investigations to be undertaken either individually, or with co-operation between the federal and provincial geological surveys.

Detailed geological mapping was continued in the English Brook area where the 1989 forest fires generated new exposures. Attention focussed primarily on the English Brook Complex in an attempt to identify the original relationships between the rock types, and to assess the mineral potential of this rather highly metamorphosed suite of felsic to ultramafic magmatic rocks. Hydrothermal alteration in the Rice Lake Group volcanic rocks was interpreted to indicate a potential for volcanogenic massive sulphide deposits.

New isotopic ages from the Wallace Lake area pointed to the existence of an older (3.0 Ga) tonalitic crust represented by boulders in the Conley Formation, and confirmed earlier ages for the main volcanic rocks in the Rice Lake region at about 2.7 Ga.

A co-operative project between Tanatalum Mining Corporation of Canada (TANCO), the GSC and the GSB was mounted to evaluate the effectiveness of biogeochemical techniques for detecting near-surface occurrences of concealed rare-element pegmatite deposits.

Thompson and Northern Superior Province

Shoreline exposures at the west end of Cross Lake were mapped in anticipation of increased water levels resulting from Manitoba Hydro's construction of a weir near the outlet of the Nelson River. The geology of this region is now much better defined, revealing an extended Archean history from 2.8 to 2.6 Ga, together with extensive evidence of reworking and dyke intrusion (1.883 Ga) during the Hudsonian orogeny .

The Branch continues to provide support and advice to company exploration programs targeted on the southwest extension of the nickel belt, and will, in the near future, issue an open file describing the key rock types and lithologic sequences in this region, that could have associated nickeliferous mineralization.

Studies of mineral deposits in the Gods Lake area concentrated on the geology of Elk and Jowsey Islands, both being past-producers of gold.

Manitoba General

Four separate projects were conducted in areas underlain by Paleozoic carbonate rocks, as part of the stratigraphic mapping and core-hole program: drilling near Dawson Bay provided additional information on the configuration of the Devonian reefal structure at The Bluff; the regional mapping of Silurian and Ordovician formations was extended to the Saskatchewan border providing correlations with counterparts in that province; several new holes were drilled in an east-west profile across the Grand Rapids Uplands, to provide additional stratigraphic information and to provide stations for setting up groundwater monitoring instruments; and input continued in the compilation of information from Manitoba as part of the Western Sedimentary Basin Atlas Project. Consultation was also provided in support of the high-calcium limestone, and high-purity dolomite commodity drilling projects in the

Interlake region and at the Narrows, Lake Manitoba. All core produced from these projects will eventually be logged and integrated into the stratigraphic core-hole index.

Industrial minerals evaluations focussed on identifying new occurrences of high-calcium limestone in the Winnipegosis and Narrows regions, south to Lily Bay, and on high-purity dolomites of the Fisher Branch Formation north of Inwood. At the latter location, 22 holes were drilled to a depth of 15m on ¼-mile centres near Sandridge, in an attempt to prove-up approximately 100 000 000 t of dolomite with a purity that would meet specifications for magnesium metal production. Analyses confirming the grade of this material, and possible tonnages, are currently in progress. Dimension stone investigations in southeastern Manitoba were extended to encompass several granitic plutons in the Bird and Winnipeg River areas. One site was deemed to contain material with potential for dimension stone development.

LITHOPROBE

Phase III of the LITHOPROBE initiative will bring to Manitoba a revolutionary new capability for defining the deeper crustal structure in northern Manitoba. Regional VIBROSEIS relection seismic profiles were completed across the Churchill/Superior Boundary Zone at Thompson (40km), and from Jenpeg in the Superior Province, across the Flin Flon/Snow Lake greenstone belt, and the Saskatchewan border (360km). Cross lines to Snow Lake and up the Sherridon road into the Kisseynew gneissic belt were also completed (142km), as was a high resolution profile providing detailed shallow crustal information across the Thompson mines structure. Initial results appear very promising with numerous well-defined reflectors showing up in the raw, unprocessed data. A workshop reporting on the results of the initial geophysical surveys is scheduled for the Spring of 1992.

ONTARIO MINISTRY OF NORTHERN DEVELOPMENT AND MINES
ONTARIO GEOLOGICAL SURVEY

Introduction

During 1990–91, the Ontario Geological Survey (OGS) carried out detailed, regional and province-wide geoscience studies. Locations of field projects carried out during 1991 are shown on Figure 1. Some OGS projects were undertaken in co-operation with Mines and Minerals Division geologists, universities and private companies. The Ministry supported applied research projects at Ontario universities through the Geoscience Research Grant Program and the Mineral Resources Grant Program.

In 1991–92, the OGS, is celebrating its centennial. To commemorate the event a special volume, the *Geology of Ontario* has been prepared. This major new synthesis of the province's geology will consist of a 1200-page volume, and 7 map themes at a scale 1:1 000 000 (a total of 35 full-colour maps). To date, the Bedrock Geology, Quaternary Geology, Shaded Image of the Total Magnetic Field, and Vertical Magnetic Gradient map themes have been released. The first half of the volume plus the Bouguer Gravity and Vertical Gravity Gradient map themes are to be released at the Ontario Mines and Minerals Symposium in December 1991. The second half of the volume, the Tectonic Assemblages map theme and a brief "popularized" version of the volume are scheduled for release in 1992. he combined effort of the geoscience and publication staff over a 2-year period to bring the Geology of Ontario project to publication as a premier applied geoscience reference is a remarkable demonstration of application, dedication and ability.

PRECAMBRIAN GEOLOGY SECTION

In 1991, the Precambrian Geology Section emphasized detailed and regional mapping projects in conjunction with a small number of thematic studies. One project was carried out by a geological consulting firm.

Fifteen bedrock mapping projects operated in various regions of the Precambrian Shield of Ontario. This represents a considerable increase compared to 1990 activities. In northwestern Ontario, regional mapping of granitic terrain and greenstones of the Berens River Subprovince continued at a scale of 1:50 000; four, detailed (1:15 840 scale) mapping projects were carried out, one each in the Uchi, Wabigoon, Wawa and Quetico subprovinces. A 1:50 000 scale, lithotectonic investigation was conducted in the Sturgeon Lake area of the Wabigoon Subprovince.

In the Abitibi Subprovince of northeastern Ontario, five, standard, detailed mapping projects, at a scale of 1:15 840, were conducted. In 1991, field work of a lithostratigraphic - structural investigation, at 1:50 000 scale, in the Larder Lake area was completed and a study of the Algoma granitic domain north of Elliot Lake was initiated.

In southern Ontario, detailed mapping and stratigraphic investigations continued in the Central Metasedimentary Belt of the Grenville Province.

Several thematic investigations conducted by staff of the section are nearing completion. A synoptic study of the Michipicoten greenstone belt, and work on the metallogeny of the Mishibishu and Michipicoten greenstone belts, is nearing completion. A geochemical study and compilation of Timiskaming metavolcanic rocks of the Superior Province, as part of an investigation of the depositional and mineralization environments of the Timiskaming rocks, was initiated.

Involvement by most staff of the section on the multi-year Geology of Ontario project is largely completed. The bedrock geology theme was released in March 1991. It is the first of the 7 map themes accompanying the *Geology of Ontario* comprehensive volume. The maps and volume will provide an overview of the geology, mineral deposits and lithotectonic framework of the Precambrian Shield and the Phanerozoic lowlands of Ontario, based on 100 years of geological investigations by the Ontario Geological Survey and its predecessors.

Over the past few years, progress has been achieved in developing OGS FIELDLOG, a cartographic software package integrated with data base software. Several staff members of the section are presently using OGS FIELDLOG, which is designed to archive field notes and facilitate map production.

In 1991, developments in field note computerization continued through testing of custom software for use in a lightweight, "pen based", handheld data recording product which will allow OGS FIELDLOG data input on traverse. It is designed to eliminate the need to transfer field notes by hand into base camp or office computers.

ENGINEERING AND TERRAIN GEOLOGY SECTION

Field investigations by the staff of the Engineering and Terrain Geology Section were undertaken in 7 areas in the province. These programs consisted of Quaternary and Paleozoic mapping, and drilling.

Paleozoic–Mesozoic Geology

The investigation of neotectonic (stress-relief) features in the Prince Edward County area of southern Ontario continued. The project was augmented by a drilling program designed to examine the Salmon River Fault. A report detailing the findings of these projects is currently being prepared.

Figure 1. Distribution and types of programs in Ontario.

Drilling was also completed in the Lake Simcoe area. This drilling program provided subsurface data to assist in the mapping of the Ordovician rocks in the area. The project is being undertaken to assess constraints on the use of the various rock units in aggregate products.

A major review and interpretation of the Paleozoic–Mesozoic geology of the province was completed as a contribution to the *Geology of Ontario* volume. This contribution compliments the bedrock geology maps.

Quaternary Geology

The Quaternary Geology Subsection continued its program of surficial mapping of the province at a scale of 1:50 000. Four maps of the Quaternary geology of Ontario, at a scale of 1:1 000 000, have been assembled and will be published in the near future. A comprehensive chapter on the Quaternary of the province has also been completed for inclusion in the *Geology of Ontario* volume.

The multi-year project in the Barrie–Elmvale area continued. This investigation is establishing the distribution, stratigraphy and glacial history of the surficial materials in the area, and will assist planning studies attempting to reach a balance between urban-industrial growth and environmental concerns.

In the Huntsville–Bracebridge area, a mapping project jointly funded by the Ontario Ministries of Northern Development and Mines and Natural Resources, and the Municipality of Muskoka, continued. The aim of this project is to identify unique elements of Muskoka's geological heritage. The mapping will also provide basic data on the distribution and character of Quaternary deposits.

In northern Ontario, projects in the Elliot Lake and Wawa areas entered their second year of field work. Both projects will provide a geological inventory that will aid in the development of effective drift-exploration strategies by documenting glacial stratigraphy, and generating geochemical data bases.

Aggregate Assessment Office

The staff of the Aggregate Assessment Office continued their work in compiling township-scale aggregate inventories in southern Ontario, and regional-scale inventories in northern Ontario. A significant number of Aggregate Resource Inventory Papers (ARIPs), open file reports (OFRs) and open file maps (OFMs) were produced for townships designated under the *Aggregate Act*. A large amount of effort was put into compiling work in townships along the Niagara Escarpment. This was undertaken as part of an independent review of the existing and potential aggregate resources in townships affected by proposed revisions to the Niagara Escarpment Planning Area.

GEOPHYSICS–GEOCHEMISTRY SECTION

Geophysics

In 1991, the geophysical contribution to the *Geology of Ontario* consisted largely of producing Bouguer gravity maps, total field magnetic maps, and computer-processed, filtered and derivative gravity and magnetic maps, all at a scale of 1:1 000 000. At this scale, the entire province of Ontario is represented on 4 map sheets.

All of the public aeromagnetic data for Ontario were recompiled into a continuous grid of total magnetic field intensity at a uniform grid spacing of 200 m. A unique computerized method, utilizing the existing Geological Survey of Canada's 812.8 m grid data base, was applied to level the 41 surveys together, thus creating a single, homogeneous, master aeromagnetic grid for the province. To enhance low-amplitude, short-wave-length, near-surface magnetic features, a shaded relief image of total magnetic field intensity was produced. A grey-scale shading was also superimposed on the colours to enhance the magnetic features and to provide more texture in the overall appearance of the total field maps. A map of the shaded image of the total magnetic field and vertical magnetic gradient maps for Ontario was published in 1991, as part of the *Geology of Ontario*.

Data processing and modern geophysical techniques have been applied to the existing gravity coverage of Ontario, consisting of approximately 58 800 gravity stations. A single, homogeneous, master Bouguer gravity grid for the province of Ontario was created at a uniform grid spacing of 1000 m. From this grid, a set of 1:1 000 000 colour maps of the Bouguer gravity, and the shaded image of vertical gravity gradient, have been generated for publication.

A research program to investigate bedrock topography and overburden stratigraphy, using shallow reflection seismic surveying, continued in 1991. One seismic line was shot near the town of Newmarket, about 40 km north of Toronto, to delineate possible bedrock valleys.

During 1991, 4 airborne electromagnetic and magnetic surveys, covering areas of high mineral potential, were released. Maps of the 4 surveys are available at 2 scales. The 1:20 000 scale maps are printed on a photomosaic base showing the flight lines, aeromagnetic total-field contours and locations of electromagnetic anomaly intercepts. The 1:31 680 scale maps show topography, flight lines and electromagnetic anomaly intercepts. Some 53 875 line-kilometres of data were surveyed in the four areas: Partridge River area, 3985 line-kilometres; Benny area, 1590 line-kilometres; Birch–Uchi–Confederation Lakes area, 26 310 line-kilometres; and Shebandowan area, 21 990 line-kilometres.

Geochemistry

In 1991, lake sediment core and water sampling was completed in the Cow River area and the Murray Lake area. The former project completes regional geochemical coverage of the Batchawana greenstone belt. The Murray lake area is located adjacent to the east of the Herman Lake regional geochemical map sheet in the Michipicoten greenstone belt. The Herman Lake sheet (Map 80 804) was released in 1990.

In March 1991, two regional geochemical maps of areas in the Batchawana greenstone belt were released. The Pancake Lake sheet (Map 80 807) is in the west of the project area along the shore of Lake Superior and the Montreal River sheet (Map 80 808) covers the northwest part of the greenstone belt. Each of the 5 regional geochemical maps released to date is accompanied by a diskette including all positional and geochemical data upon which a regional geochemical map is based. The planning of a mobile laboratory unit (MLU) continues and construction of the laboratory is expected in the near future. During the past year modifications to the MLU plan have been made to make it suitable for use in certain environmental projects.

GEOSCIENCE LABORATORIES SECTION

The Geoscience Laboratories, through the implementation of a laboratory information management system (LIMS) in 1989, has continued to develop protocols for the validation and certification of data under the quality assurance program, as outlined in the Summary of Field Work and Other Activities (OGS Miscellaneous Paper 157, 1991).

A central theme has been the development of automated technologies for the analysis of geological materials. The application of such technologies to geological programs is underway and there have been spin-off benefits from the transfer of the methods to the private sector. Examples of these developments are given below:

Mineral Sciences Program

The application of new technologies and automation of sample preparation and analytical schemes has continued. A soil crushing system is now used for the preparation of materials for ASTM determinations. The Laboratories have continued to develop methods for the preparation of polished thin sections for use in the microprobe laboratory of the new Mines and Minerals Research Centre in Sudbury. Methods have been developed for the magnetic separation of mineral phases using Frantz Isodynamic Magnetic Separator, and a Magstream Separator. Automation of XRD determinations of clay mineral

assemblages and the automated determination of mineral properties by XRD and/or image analysis continues to be investigated for application to specific projects.

Elemental Analysis Program

Improvements in methodologies used to determine specific analytes such as FeO have been undertaken using an auto-titration system. A fluxer for the preparation of samples for XRD analysis has been brought on-line and can routinely prepare fused glass discs.

The development of the ICP-MS method for the analysis of petrogenetically important analytes (Ta, Hf, Rb, Sr, Nb, etc.) has been completed. This work has been extended to complete the development of an ICP method for the determination of the platinum group elements, and the transfer of methodologies onto a new ICP instrument in the Sudbury facility.

Joint Projects and Partnerships

In a joint program involving ISOTRACE group at the University of Toronto, the characterization of standard reference materials for platinum group element analysis has been undertaken.

The Ontario Geological Survey has developed an international scientific exchange program with the Institute for the Geology of Ore Deposits, Mineralogy, and Geochemistry, Soviet Academy of Sciences, and scientific exchange of ideas on the investigation of Ni, Cu, and platinum group element deposits in mafic and ultramafic rocks is underway.

In order to further "bridge the gap" between geoanalysis and geology, a handbook on the analysis of geological materials is being compiled.

GEOSERVICES SECTION

The Geoservices Section consists of the Geoscience Information Services Subsection, the Publication and Cartographic Services Unit, and the Geoscience Data Centre.

Geoscience Information Services

The Geoscience Information Services Subsection provides an information and referencing service on the geology and mineral resources of Ontario. Clients have access to a comprehensive library of government reports and maps, geoscientific and technical texts and journals, and property reports submitted by the exploration industry.

The geoscience information officer is available to answer general geoscience inquiries from all sources, and to prepare general interest publications and displays on geoscience topics.

Publication and Cartographic Services

Since August 1991, the "Geology of Ontario" project has been the major publishing priority of the Publication and Cartographic Services Unit.

The viability of the Survey's new "fast-track" method of report and map production was proven by the statistics: 21 reports and 19 full-colour maps were released during the first 18 months of production, compared to 7 reports and 8 maps during the previous 18 months. The fast-track method is being studied by other geological surveys, including the Geological Survey of Canada, as a possible means of improving their data delivery procedures.

Funding for publications from the Canada-Ontario Mineral Development Agreement (COMDA) ended on March 31, 1991. All COMDA-related publications have been released as of September 1991. Output from the five-year program comprises 12 Geological Reports, 1 Miscellaneous Paper, 2 Mineral Deposits Circulars, 7 Industrial Mineral Background Papers, 4 Aggregate Resources Inventory Papers,

55 Open File Reports, 18 Final (colour) Maps, 56 Preliminary Maps, 42 Open File Maps, 55 geophysical/geochemical maps and 237 Geological Data Inventory Folios, for a total of 489 publications.

The Ontario Geological Survey hosted a one-day informal meeting of Canadian geological surveys in March. Attended by representatives from three provincial surveys and the GSC, this round-table discussion provided an opportunity to discuss matters of common concern, including privatization, marketing, pricing, style guidelines and the locating and training of staff. A similar meeting will be held in conjunction with the 1992 GAC-MAC Joint Annual Meeting in Wolfville, Nova Scotia. The organizers are expanding the format to include editors of Canadian geoscience journals and freelance editors.

Geoscience Data Centre

The Geoscience Data Centre completed research and development work on the application of spatial information system technology under the GEOSIS program in March 1991. The Geoscience Exploration Data project (GED), based on this research, completed its first year with the updating of the Mineral Deposit Database (MDI).

The GED project, in its second year, will make available Ontario-wide digital map files for Energy Mines and Resources' 1:250 000 topographic map data, the OGS's Geology of Ontario map data and locational data for MDI. Information from the GED project will be available through any of the fifteen Resident Geologists' offices in the province, in addition to the OGS.

GEOSCIENCE RESEARCH GRANT PROGRAM

In 1991, the Ontario Geoscience Research Grant (OGRG) program awarded 22 grants, totalling $508,000 to 11 universities. The grant program finances research that will improve and stimulate mineral resource development and management in Ontario, research which compliments but does not duplicate the activities of the OGS. Summaries of research for the 1989-90 grants were published as OGS Miscellaneous Paper 150, in December 1990. In addition, oral and poster presentations by OGRG recipients were presented during the annual Ontario Mines and Minerals Symposium, held December 10-12, 1990 at the Metro Toronto Convention Centre.

In 1991, other geoscience research grants were awarded to Ontario universities and colleges, companies, and professional organizations to fund projects which benefit the programs and priorities of the Ministry's mineral resources program. Results achieved from these grant projects are released in a variety of formats, including open file reports, poster and oral presentations, and articles in external publications.

MINISTÈRE DE L'ÉNERGIE ET DES RESSOURCES
GOUVERNEMENT DU QUÉBEC
SECTEUR "MINES"

Pour l'année financière 1991-92, l'objectif de base du ministère, en ce qui concerne le Secteur mines, est de promouvoir le développement de l'industrie minérale du Québec par un ensemble de mesures visant à appuyer l'initiative et le leadership du secteur privé, tout en s'assurant que l'exploitation des ressources minérales se fait selon les meilleurs intérêts des québécois. Plus particulièrement, il s'agit de :

1. stimuler les investissements privés pour le développement de nouveaux gisements, l'expansion des capacités de production existantes et la modernisation des usines de première transformation;

2. localiser la recherche et le développement sur des projets spécifiques répondant aux besoins de l'industrie et pouvant aider à consolider notre position concurrentielle et susciter le développement industriel à court et moyen termes;

3. contribuer au renouvellement des réserves domestiques pour les minerais de cuivre et de zinc et favoriser la diversification de la production minérale dans les régions du Québec par la stimulation de l'exploration minière;

4. assurer la promotion et la défense de l'amiante et, au niveau mondial, promouvoir l'adoption de législations visant un usage sécuritaire de ce produit.

Chacune des trois directions générales du Secteur "mines" répond plus spécifiquement à l'un ou l'autre des grands objectifs cités.

Depuis janvier 1990, la direction du Secteur mines et deux de ses directions générales (DGIM et DGEGM) occupent de nouveaux locaux, situés au 5700, 4e Avenue Ouest, à Charlesbourg, en banlieue de Québec.

LA DIRECTION GÉNÉRALE DE L'INDUSTRIE MINÉRALE (DGIM)

La Direction générale de l'industrie minérale est chargée d'administrer les lois minières, de tenir à jour les connaissances relatives au contexte fiscal, économique et réglementaire dans lequel évolue le secteur minéral et de favoriser la mise en valeur, l'exploitation, la transformation primaire et la mise en marché des ressources minérales du Québec, et ce, dans une perspective de développement durable pour la collectivité québécoise.

Le Service de la statistique et de l'économie minérale (SSEM)

Au sein de la Direction de l'analyse économique et du développement minier, le Service de la statistique et de l'économie minérale est chargé de tenir à jour les connaissances statistiques propres aux activités de l'industrie minière québécoise et économiques reliées au contexte dans lequel elle évolue.

De plus, le SSEM participe à la recension et à l'élaboration des politiques qui guident l'action gouvernementale en vue de favoriser la mise en valeur, l'exploitation, la transformation primaire et la mise en marché des ressources minérales du Québec par l'industrie dans une perspective de développement durable pour la collectivité québécoise.

De façon plus spécifique, le Service de la statistique et de l'économie minérale :

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Service géologique de Québec
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M. Alain Simard, chef de service
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400, boul. Lamaque
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LES BUREAUX DES GÉOLOGUES RÉSIDENTS

Service géologique de Québec

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Montréal (QC) H3G 1X1
M. Yvon Globensky
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ESTRIE - LAURENTIDES
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Sherbrooke (QC) J1H 4A9
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Télécopieur: (819) 820-3948

CÔTE-NORD - NOUVEAU-QUÉBEC
456, rue Arnaud, bureau 1.04
Sept-Îles (QC) G4R 3B1
M. Roch Gaudreau
Téléphone: (418) 968-2110
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GASPÉSIE - ÎLES-DE-LA-MADELEINE
16, 1re Avenue Ouest
Case postale 697
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M. Gilles Duquette
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Télécopieur: 418 763-2958

Service géologique du Nord-Ouest

ROUYN-NORANDA
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Rouyn-Noranda (QC) J9X 6N5
M. Maurice Rive
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Mme Chantal Dussault
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CHIBOUGAMAU
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Chibougamau (QC) G8P 1N4
M. Remy Morin
Téléphone: (418) 748-2663
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- recueille, vérifie, traite et publie des données statistiques sur les activités des compagnies minières et des agents d'exploration au Québec;

- analyse l'évolution des divers secteurs de l'industrie minérale québécoise en contact avec les principaux acteurs du domaine afin de dégager les perspectives d'avenir, collabore au recensement et à l'élaboration des politiques gouvernementales, participe à l'orientation de la planification stratégique du Secteur mines et propose des interventions appropriées;

- publie des périodiques, informe les agents économiques des performances et des perspectives de l'industrie minière et fournit, sur demande, des informations statistiques non-confidentielles;

- participe au suivi de l'évolution des politiques gouvernementales, des activités et de la réglementation des principaux organismes ayant une incidence directe sur l'industrie minière afin de proposer des interventions susceptibles de favoriser l'industrie;

- formule des avis à l'intention des autorités du ministère de l'Énergie et des Ressources et d'autres organismes gouvernementaux.

En 1991-1992, le SSEM prévoit produire, outre les publications périodiques (La ressource minérale, L'industrie minérale du Québec, Bulletin d'économie minérale, Statistiques de la production minérale, Statistiques sur l'industrie minérale, Statistiques sur l'investissement de l'industrie minérale du Québec) diverses études portant, notamment, sur l'économique de l'exploration, l'impact des mesures environnementales sur l'industrie minière, la problématique de la main-d'oeuvre, la problématique des activités de R/D des entreprises minières, et la politique minière du Québec.

Le Service du développement minier (SDM)

Le SDM a comme principaux mandats de :

- Promouvoir la réalisation de projets d'investissements pouvant contribuer au développement durable de l'industrie minérale, notamment en proposant des interventions gouvernementales appropriées et en administrant certains programmes d'assistance financière.

- Suivre et analyser l'évolution des activités des intervenants dans chacun des secteurs de l'industrie minérale du Québec dans le but de fournir à la direction du MER et à ses gestionnaires des informations et des avis pertinents sur leur état de situation et leurs perspectives d'avenir, de contribuer à la planification stratégique des activités du Secteur mines du Ministère et de suggérer des interventions ou des politiques sectorielles appropriées.

- Suivre et analyser les politiques gouvernementales et les mesures législatives des principaux organismes ayant une incidence directe sur les activités de l'industrie minière, afin d'en mesurer les impacts et de proposer des interventions ou des orientations susceptibles de contribuer au mieux-être de l'industrie.

En 1991-1992, le SDM prévoit plus particulièrement produire une mise à jour périodique de l'inventaire des projets miniers au Québec et une analyse des opportunités d'investissements, des synthèses sectorielles des industries du granite, de la tourbe et de la silice, une évaluation du programme d'assistance sur les études technico-économiques et travaux d'expérimentation en vue de sa reconduction. Il poursuivra également la mise en oeuvre du programme d'aide spécial pour la région Chibougamau-Chapais-Desmaraisville, ainsi que ses études et travaux de restauration et de sécurisation de sites miniers, particulièrement au niveau des parcs à résidus appartenant à la Couronne. Enfin, il entend continuer ses analyses des incidences économiques des politiques et des règlements touchant l'environnement dans le secteur minier et l'accessibilité au territoire.

Actions accréditives

Le gouvernement du Québec, dans le discours sur le budget du 2 mai 1991, a poursuivi sa politique d'encouragement au financement de l'exploration minière en prolongeant de deux ans, soit jusqu'au 1er janvier 1994, les allocations additionnelles relatives aux frais d'exploration engagés au Québec. De plus, les frais d'émission, jusqu'à concurrence de 15 % du produit d'une émission d'actions accréditives s'ajoutent désormais à la déduction de base de 100 % à l'impôt du Québec; ces frais d'émission n'entrent pas non plus au calcul des pertes nettes cumulatives sur placements (PNCP). Le 2 mai, le ministre des Finances a aussi annoncé la création d'un programme de soutien de 5 M$ pour les compagnies juniors; ce programme est administré par la Société québécoise d'exploration minière (Soquem).

Rappelons que les frais d'exploration définis comme «frais de surface» engagés au Québec par un particulier sont devenus admissibles, à compter de l'année d'imposition 1989, à une déduction de 166 2/3%; les frais souterrains de puits, rampes, ou galeries d'exploration ou de forage sous terre demeurent valables pour une déduction de 133 1/3%. De plus, à compter de l'année d'imposition 1989, les frais d'exploration qui sont admissibles aux allocations additionnelles de 33 1/3% ou de 66 2/3%, selon le cas, n'entrent plus au calcul des pertes nettes cumulatives sur placements (PNCP) à l'impôt du Québec.

Loi sur les mines

Cette loi prévoit les diverses modalités relatives à l'attribution des droits miniers, et elle édicte les conditions d'exercice de l'activité minière au Québec. Le 17 juin 1991, l'Assemblée nationale du Québec décidait de modifier à nouveau la Loi sur les mines en adoptant le projet de Loi 130 (1991, chapitre 23), principalement afin d'assurer le réaménagement et la restauration d'un terrain affecté par des activités minières.

Ainsi, une personne qui effectue certains travaux miniers d'exploration ou d'exploitation, qui dirige une usine de concentration de certaines substances minérales ou qui effectue certains travaux d'exploitation à l'égard de résidus miniers sera dorénavant tenue de faire approuver par le ministre un plan de réaménagement et de restauration du terrain affecté par ses activités, de se conformer au plan et de déposer une garantie à cet effet. En cas de défaut, le ministre pourra notamment faire exécuter les travaux requis aux frais de la personne qui omet de se soumettre à ces exigences et, s'il ne peut en recouvrer les frais au moyen de la garantie, toute somme due à la Couronne constituera une dette privilégiée sur tous les biens du débiteur. La loi 130 comporte également une disposition par laquelle le ministre pourra enjoindre une personne qui a déjà cessé ses activités minières sur un site donné, de procéder à des travaux de réaménagement et de restauration nécessités par la présence de résidus miniers.

Par ailleurs, la loi 130 indique que certains territoires pourront être délimités à des fins non exclusives de récréation, de tourisme et de conservation de la flore ou de la faune et que certaines conditions spécifiques pourront être imposées à l'égard des travaux miniers effectués dans ces territoires. En procédant ainsi, le gouvernement québécois espère conserver accessible à l'industrie minière la plus grande partie de son territoire, tout en tenant compte de ses autres utilisations.

LE CENTRE DE RECHERCHES MINÉRALES (CRM)

Le Centre de recherches minérales (CRM) constitue l'une des trois directions générales du secteur Mines, de l'actuel ministère de l'Énergie et des Ressources. Il compte 130 employés permanents (chercheurs, techniciens, fonctionnaires et ouvriers) et une trentaine d'employés occasionnels. Il dispose en 1991-1992 d'un budget annuel d'une dizaine de millions $. Il est doté d'un Comité consultatif, dont les membres proviennent des milieux de la recherche et des entreprises du secteur minier et métallurgique.

Au cours des années, le CRM est parvenu à rejoindre progressivement les entreprises et à développer une clientèle fidèle. En 1990-1991, la valeur des 125 projets réalisés pour le compte des entreprises a atteint 3,0 millions de dollars.

Sa clientèle se concentre dans le secteur minéral du Québec, qu'il s'agisse d'entreprises minières ou métallurgiques, de firmes juniors d'exploration, de compagnies de génie-conseil, de laboratoires ou de centres de recherches engagés dans des domaines d'activité correspondants. Il faut ajouter, à ce noyau d'une centaine d'entreprises ou organismes, plusieurs usines de transformation dont les procédés traitent ou utilisent des substances minérales. Tout compte fait, ce sont plus de 300 établissements qui peuvent faire appel aux services du CRM, plusieurs d'entre eux de façon régulière.

Le CRM dispose d'une expertise reconnue, d'un savoir-faire certain pour adapter, améliorer ou tester des procédés existants, ou nouveaux, pour tout ce qui touche le traitement ou la transformation des substances minérales. Ses équipements, en laboratoires et à l'usine pilote, lui permettent de réaliser des travaux axés sur le développement et l'optimisation de procédés et de contribuer ainsi de façon significative aux efforts des entreprises en R&D.

En 1990-1991, le CRM a effectué l'analyse de quelque 44 000 échantillons, dont les deux-tiers proviennent de la Direction générale de l'exploration géologique et minérale du Ministère. De plus, il gère une dizaine de projets prévus au volet technologique de l'Entente auxiliaire de développement minéral pour un montant de 472 000 $ en 1990-1991. De plus, le CRM assure la participation gouvernementale du Québec au programme Nedem (Neutralisation des eaux de drainage dans l'environnement minier), pour un montant qui a atteint 458 000 $ en 1990-1991.

La raison d'être du CRM traduit sa fonction gouvernementale et c'est de contribuer au développement des entreprises québécoises qui oeuvrent dans les domaines de l'exploration, de l'exploitation, du traitement et de l'utilisation des substances minérales.

Sa mission est de développer et optimiser les procédés d'exploitation et de traitement des susbtances minérales, tout en offrant des services d'analyse minérale.

Encore plus que par le passé, le CRM entend donner un service de qualité à ses clientèles. Il tentera de répondre à la fois à ses besoins de court terme d'applications industrielles, qui concernent surtout l'amélioration ou l'adaptation aux nouvelles technologies de procédés existants et, à ceux de plus long terme, ce qui exige le développement de nouveaux procédés, donc plus de risques sur le plan financier.

Le CRM entend maintenir sa position de leader dans un certain nombre de secteurs. En développement et implantation de stratégies de contrôle, le CRM fera des efforts supplémentaires pour devenir pour l'industrie minérale un centre d'excellence dans l'application aux opérations de l'automatique et de la simulation et pour augmenter son niveau d'intervention en industrie. Dans le domaine du hissage, il assurera un transfert de technologie vers l'industrie pour lui conférer une plus grande autonomie. Le CRM s'impliquera davantage dans le transfert de connaissances en étant encore plus actif dans l'organisation de colloques, de cours et de séminaires spécialisés.

La place qu'occupe le CRM dans le réseau de la R&D minérale, lui permet de mobiliser les expertises et les ressources disponibles au Québec ou ailleurs, coordonner de tels projets en participation, et les mener à terme.

Le CRM devra consentir des efforts importants à l'identification, avec l'industrie, de projets de nature plus générique, qui répondent à des problèmes communs à plusieurs entreprises, à la mise sur pied de ces projets conjoints, et à la collaboration avec les autres centres ou organismes du réseau de la recherche minérale pour leur réalisation. L'industrie minérale entend d'ailleurs privilégier ce type de projets, qui renforce la liaison université-entreprise tant recherchée et accélère le transfert technologique en mettant l'accent sur l'environnement et la productivité.

DIRECTION GÉNÉRALE DE L'EXPLORATION GÉOLOGIQUE ET MINÉRALE (DGEGM)

L'année financière 1991-92 est marquée par un plus faible niveau d'activités en acquisition de connaissances géoscientifiques et par la poursuite du programme d'assistance financière à l'exploration minière. En 1991-92, seul le programme d'assistance financière à la prospection minière dans l'Est du Québec bénéficie de l'Entente de développement économique des régions du Québec (EDERQ) intervenue entre Québec et Ottawa.

La DGEGM consacre 7,2 millions de dollars au volet "acquisition de connaissances" et un montant de 5,9 millions de dollars est consacré à des programmes d'assistance financière à l'exploration ainsi qu'à la préparation et à la diffusion de la géoinformation.

Direction de la recherche géologique (DRG)

La Direction de la recherche géologique (DRG) a pour mandat d'étendre et de raffiner la connaissance géologique de base du territoire afin d'en arriver à l'identification de zones à potentiel minéral élevé.

Pour la mise en oeuvre de ses programmes, la DRG a recours à deux services géologiques (Nord-Ouest et Québec).

Service géologique de Québec (SGQ)

Le Service géologique de Québec dessert les deux tiers du territoire québécois dont les Appalaches, les Basses-Terres du Saint-Laurent, la majeure partie du Grenville et l'ensemble du territoire du Nouveau-Québec reposant au nord du 55^{e} parallèle. Il gère quatre bureaux régionaux, animé chacun par un géologue résident, alors que métallogénistes, géologues régionaux, géophysiciens et géochimistes ainsi que le personnel de la Division des minéraux industriels sont regroupés au bureau de Charlesbourg.

Au cours de l'année 1991-1992, le Service géologique de Québec disposait d'un budget de 3,4 millions de dollars pour la réalisation de 31 projets de terrain et l'achèvement de seize autres projets entrepris l'année précédente. Le budget global est réparti entre quatre divisions régionales, correspondant aux districts régionaux, et deux divisions thématiques.

La **Division Côte-NordNouveau-Québec** dispose d'un budget de 1,1 million de dollars, dont 222 K$ ont été consacrés à la Fosse de l'Ungava, 199 K$ à la Fosse du Labrador (incluant son avant-pays et son arrière-pays) et 681 K$ à la Côte-Nord. Aucun travail de terrain n'a été poursuivi dans la région de la Fosse de l'Ungava, mais les efforts ont porté sur l'achèvement des études destinées à mieux définir le potentiel économique du territoire couvert entre 1983 et 1988, à optimiser les données recueillies et à continuer la préparation d'un mémoire. Pour la Fosse du Labrador et les territoires adjacents à l'est et à l'ouest, les travaux ont consisté en recherches métallogéniques destinées à la préparation d'un mémoire qui doit être réalisé au cours de 1992. Pour une troisième année consécutive, les travaux sur la Côte-Nord, incluant la région de Fermont, se sont poursuivis; ils portent sur la continuation d'un levé au 1:50 000 aux environs de Forestville ainsi que sur la réalisation d'un levé géophysique aéroporté dans la région de Fermont.

La **Division Montréal-Laurentides** compte sur un budget de 355 K$. La compilation de la cartographie entreprise dans la région de Thurso s'est poursuivie de même que la continuation de l'étude des grands corridors de déformation. L'étude métallogénique d'indices de métaux rares a été amorcée pour les secteurs de ManiwakiMont-Laurier.

Les travaux sur le territoire de la **Division Estrie-Laurentides** ont été menés avec un budget de 1 000 K$, dont la majeure partie sera dépensée sur le territoire de l'Estrie et de la Beauce. Environ 200 K$ serviront à définir le potentiel minéral et à cartographier le segment du Grenville compris entre les rivières Saint-Maurice et Saguenay, en incluant la région au nord du lac Saint-Jean. Deux levés

géophysiques héliportés ont été réalisés. Ces travaux constituent la deuxième phase d'une programmation quinquennale visant à mettre l'accent sur la réalisation de levés géophysiques aéroportés et à compléter la couverture géologique au 1:50 000, particulièrement dans les régions dont le potentiel économique semble vouloir se confirmer, tant dans le Grenville qu'en Estrie-Beauce.

Depuis près de cinq ans, l'ensemble des travaux géoscientifiques réalisés en Gaspésie par la **Division GaspésieLes Îles** sont répertoriés, compilés, analysés et réinterprétés dans le but d'optimiser l'information déjà disponible et de réaliser une nouvelle couverture cartographique au 1:50 000 et au 1:250 000. Les premiers feuillets de cette nouvelle série devraient être disponibles sous peu. Les travaux de terrain entrepris sont à caractère gîtologique et visent à mieux définir le potentiel minéral des principales structures le long desquelles se retrouvent la plupart des indices minéralisés mis à jour sur ce territoire. Quelque 306 K$ y seront consacrés.

La **Division des minéraux industriels, de la tourbe et des matériaux de construction** dispose d'un budget de 458 K$ pour la réalisation d'inventaires des sources de granulat, de tourbe, de silice, de calcaire, de dolomie, de granit architectural et de wollastonite. Les travaux d'inventaire des sources de granulat ont été effectués sur la Côte-Nord et dans la région de la Beauce. De plus, une étude sur le potentiel économique des sables de la Côte-Nord a été entreprise avec la collaboration du personnel travaillant en géochimie.

La **Division de la géochimie et de la géophysique** s'occupe de gérer les levés, les études et les compilations menées sur le territoire du SGQ. Le Service géologique de Québec a, par l'entremise de cette Division, dépensé 381 K$ pour des levés de géophysique et 140 K$ pour de la géochimie.

Service géologique du Nord-Ouest

Le Service géologique du Nord-Ouest (SGNO) dessert tout le Nord-Ouest québécois. Les divisions de Rouyn-Noranda, de Val-d'Or et de Chibougamau, chacune animée par un géologue résident, sont logées dans les bureaux régionaux des mines. Le personnel de la Division des gîtes minéraux et celui de la direction du service sont regroupés dans le bureau de Val-d'Or. Le Service compte également une Division de géochimie et de géophysique.

Le SGNO dispose, pour l'année 1991-1992, d'un budget de 2,7 millions ce qui représente une diminution de 20% par rapport à l'année dernière. Compte tenu de la réduction significative de son budget, le SGNO a dû réduire le nombre et l'envergure des levés géologiques et géophysiques et se résigner à n'entreprendre aucun nouveau levé géochimique. Le SGNO a également fait moins appel aux firmes et aux instituts. Cela est particulièrement vrai dans le domaine de la métallogénie où la Division des gîtes minéraux a réalisé, en régie, la plus grande partie des travaux.

À cause de la coûteuse logistique requise, un seul levé (1:20 000) fut effectué en région isolée soit celui du lac Troïlus. Il s'agit toutefois d'un levé important puisqu'un gîte prometteur (Minnova/Kerr-Addison) se trouve en plein coeur de la région levée. D'autres levés détaillés ont été amorcés ou poursuivis dans des secteurs clés pour l'exploration minérale soit ceux de Rohault près de la mine Joe Mann, de Lebel-sur-Quévillon près des gîtes de Grevet et de Porcupine-Destor qui englobe le secteur de la mine Duquesne. Ajoutons qu'un important levé de reconnaissance a été complété dans le Grenville, à l'est de Val-d'Or, de façon à compléter la couverture géologique du Nord-Ouest.

Au niveau des études, il faut souligner les efforts déployés dans la région de Val-d'Or afin de redéfinir le cadre stratigraphique et le contexte des gîtes. L'acquisition de nouvelles données sismiques (Lithoprobe), dans la région de Rouyn-Noranda, a amené le SGNO à intensifier ses travaux dans certains secteurs. De plus, le SGNO a entrepris de participer à l'analyse et à l'interprétation des données sismiques.

Dans le domaine de la métallogénie, la Division des gîtes minéraux a poursuivi ses travaux sur les minéralisations de métaux usuels et de métaux précieux. On a également amorcé des travaux sur les minéralisations de sulfures disséminés associées aux roches granitoïdes.

Dans le cadre du projet de système d'information géominière du Québec (SIGÉOM), le SGNO a continué de piloter divers projets.

Le Service attend beaucoup du traitement et de la mise en carte des donnécs géochimiques acquises en 1990 dans le secteur de Belleterre.

Enfin, signalons que le réaménagement des trois carothèques du Nord-Ouest est presque complété et que l'on prévoit la production d'un premier répertoire durant l'année.

Au niveau des réalisations hors programmation, mentionnons la forte participation du SGNO au congrès de l'Association géologique du Canada et de l'Association minéralogique du Canada, lequel, cette année, fut réalisé conjointement avec la Society of Economic Geologists. Onze géologues du SGNO ont présenté des posters ou présenté des conférences, participé à la rédaction de livrets-guides d'excursion ou participé à l'organisation et l'animation d'une session.

Direction de l'assistance à l'exploration minière

Le mandat de la Direction de l'assistance à l'exploration minière est de fournir une aide à l'industrie d'exploration minière grâce au traitement, à la gestion et à la diffusion de l'information géoscientifique et grâce à la gestion de certains programmes d'assistance financière à l'exploration.

Service de la géoinformation

Le Service de la géoinformation a édité et mis en forme, au cours de l'exercice financier 1990-1991, 84 nouveaux documents géoscientifiques faisant état des résultats des travaux géologiques, géochimiques et géophysiques réalisés par le Ministère. Ces documents sont diffusés à la clientèle minière par la Division des données géoscientifiques.

Par ailleurs, les travaux d'expérimentation et de planification en vue de l'implantation d'un système intégré d'information géominière à référence spatiale (le SIGÉOM) sont terminés. Ce système nécessitera un investissement de quelque dix millions de dollars sur cinq ans.

Division des données géoscientifiques

La Division des données géoscientifiques regroupe les activités du Centre de diffusion, de même que les activités ayant trait aux données sur les gîtes (banque COGITE), aux cartes de localisation des travaux géoscientifiques ainsi qu'à l'information de nature promotionnelle et éducationnelle. Au cours de l'exercice 1990-1991, la division a reçu 538 nouveaux dossiers d'exploration minière soumis au Ministère en vertu de la Loi sur les mines. Près de 600 dossiers d'exploration ont été rendus publics. À cela s'ajoutent 188 nouvelles publications géoscientifiques découlant des travaux géoscientifiques du Ministère.

Le Centre de diffusion a traité plus de 2 400 commandes, ce qui représente 25% de moins que l'exercice précédent. Dans le contexte de la récession, la division a réduit de 12 à 10 le nombre annuel de numéros de son bulletin d'information REPÈRES dont le délai moyen de réalisation a été de 11 jours ouvrables, livraison comprise.

Après négociation, une nouvelle politique de tarification a été approuvée par le ministère des Finances et est entrée en vigueur au début janvier 1991, date à laquelle les nouvelles taxes, TVQ (8%) et TPS (7%) ont également été implantées. Ces modifications ont coïncidées avec la sortie, au cours du même mois, de la 3e édition du RÉPERTOIRE DES PUBLICATIONS DE LA DGEGM.

Une nouvelle édition de la LISTE DES RAPPORTS D'EXPLORATION MINIÈRE PAR CANTONS (5 500 pages) a été réalisée et envoyée aux 7 bureaux régionaux des mines pour remplacer l'édition de 1986 jusqu'alors disponible dans chacune des salles de consultation mises à la disposition des clients.

Nous avons donné le nom COGITE à la base de données sur les gîtes minéraux, laquelle comprend également les nouveaux indices minéralisés répertoriés mensuellement. Cette banque comprend à ce jour quelque 7 000 gîtes et indices minéralisés.

Au cours de l'exercice, 31 nouvelles fiches de gîtes ont été créées et plus de 250 autres ont été mises à jour. Plus de 100 nouveaux indices minéralisés ont été répertoriés. Au total, 46 cartes de localisation des gîtes minéraux ont été produites et publiées. Un manuscrit brut énumérant les sites montrant des minéraux visibles en forme cristalline a été préparé pour publication à partir d'un fichier informatique existant dans la division. Ce rapport vise à permettre aux collectionneurs et vendeurs de minéraux de s'approvisionner au Québec plutôt qu'ailleurs. Il vise à stimuler la découverte de tels minéraux pouvant permettre leur éventuelle mise en marché.

Les travaux de plus de 3 000 dossiers d'exploration minière (série GM) ont été localisés sous forme manuscrite ce qui représente plus de 4 000 périmètres tracés et plus de 10 000 forages localisés sur cartes.

Notre responsable des activités de promotion-éducation a coordonné 15 sorties promotionnelles au cours du dernier exercice. De ces 15 sorties, 8 étaient axées sur une clientèle populaire, 4 vers une clientèle spécialisée et 3 sorties étaient principalement à but éducatif (présentations dans des écoles).

Environ 24 000 personnes ont été informées directement lors de ces sorties. La documentation et les échantillons ont été les outils privilégiés par les animateurs.

Les produits de promotion-éducation réalisés en cours d'exercice ont été : le document «COUP D'OEIL SUR L'EXPLORATION MINIÈRE» et le document «LE SECTEUR MINES À VOTRE SERVICE», tous deux dans la série géologie pour tous (GT), une maquette sur les phénomènes géologiques (évolution de la croûte terrestre, plis, failles, gisements, etc), un stand et un document sur les outils de repérage de l'information géoscientifique et un sac en papier avec le sigle géologue-marteau et l'identification du MER.

Un sondage d'opinion a été réalisé en vue notamment d'évaluer les besoins de notre clientèle spécialisée. L'analyse des résultats a commandé des actions de notre part dont, la plus importante, est d'avoir rendu disponibles les données de nos banques EXAMINE et COGITE en accès direct à partir des équipements de nos clients. Une entente a été conclue à cet effet avec le Service documentaire multimédia de Montréal. L'accès simultané aux deux banques sur un seul serveur, est de nature à favoriser l'interrogation en ligne.

Dans le cadre de SIGÉOM, un projet-pilote a été réalisé à la DDG en vue de numériser des cartes de localisation. Les résultats obtenus sont des plus prometteurs. Plus de 80% des publications de la DGEGM ont ainsi été numérisées. Un autre projet-pilote en cours vise à réaliser, avec le logiciel MICROSTATION, des cartes de localisation des gîtes minéraux, à partir de la base COGITE.

L'assistance financière à l'exploration

La Direction de l'assistance à l'exploration minière a géré deux programmes d'assistance financière en 1991-92 :

- un nouveau programme fédéral-provincial d'assistance financière à la prospection minière dans l'Est du Québec (Bas-Saint-Laurent et Gaspésie -Iles-de-la-Madeleine);

- Le programme d'assistance financière à la prospection minière dans le district de Chibougamau.

Dans le cadre du programme de l'Est du Québec, une centaine de prospecteurs ont bénéficié d'assistance financière et plusieurs propriétés ont été valorisées; une subvention a été accordée à un fonds minier dans le Bas-Saint-Laurent où un montant d'argent équivalent à cette subvention a été souscrit par les municipalités et les organismes locaux; d'autres subventions ont été accordées,

notamment à l'Association des prospecteurs du Québec, pour des services dispensés aux prospecteurs et pour des activités de promotion des échantillons et indices découverts.

Pour la seconde année, le district minier de Chibougamau-Chapais a profité d'un programme d'assistance financière à la prospection minière, programme dont plus d'une vingtaine de prospecteurs se sont prévalus.

En outre, une subvention de 130 000 $ a été accordée à l'Assemblée de concertation et de développement de l'Estrie, dans le cadre d'activités liées à la formation et à l'encadrement de prospecteurs.

Au total, plus de 1,8 M$ ont été budgétés pour l'assistance financière à la prospection et à l'exploration minière en 1991-92.

L'avancement du projet de géomatique du ministère de l'Énergie et des Ressources du Québec

Le ministère de l'Énergie et des Ressources du Québec (MERQ) a entrepris l'implantation d'un système d'information géominière à référence spatiale (le SIGÉOM) qui facilitera, pour l'industrie minière et le MERQ, l'accès, le traitement et la diffusion de l'information géoscientifique et minière disponible concernant le territoire québécois.

L'implantation fait suite à une démarche structurée de planification entreprise depuis 1987. Cette démarche a comporté la réalisation d'un plan directeur des systèmes d'information, d'une étude d'opportunité technologique et d'un projet pilote d'utilisation de la géomatique dans une région minière particulièrement active (région de Rouyn-Noranda). Les résultats très encourageants de ce projet ont conduit à des mises à l'essai du prototype développé, pour expérimenter en situations opérationnelles concrètes le fonctionnement du futur système. Finalement, une conception administrative, élaborée à la lumière des informations recueillies précédemment, a complété la planification détaillée du système à implanter.

Le SIGÉOM sera donc un système intégré d'accès, de traitement et de diffusion de l'ensemble de l'information géominière à référence spatiale du Québec. Cette information comprend la géologie, la géochimie, la géophysique, les gîtes minéraux, la localisation des travaux et les données de compilation issues des dossiers d'exploration minière. Dans un premier temps, les données de localisation des titres miniers ne seront pas incorporées au système; la situation sera réévaluée dans deux ans.

Afin de permettre aux compagnies d'exploration minière, qui le désirent, d'utiliser le système pour y incorporer leurs propres donnés et leurs propres traitements, le SIGÉOM utilisera des logiciels commerciaux reconnus (Microstation, dBASE IV, Oracle), opérant sur des micro-ordinateurs de type IBM PC courants.

L'implantation du SIGÉOM impliquera des investissements de dix millions de dollars. Sa mise en place nécessitera des efforts et des ressources importantes de la part du MER. De nombreux travaux de planification, de développement, de numérisation, de mise à jour et de conversion de données, d'implantation et de formation seront entrepris et devront être coordonnés afin de réaliser ce projet. Certains de ces travaux sont déjà entamés. La majorité de ces travaux seront confiés à l'entreprise privée.

Compte tenu de l'envergure du SIGÉOM, sa mise en oeuvre doit être échelonnée en plusieurs phases et sur plusieurs années. Le MER a élaboré un scénario d'implantation qui définit la composition et l'ordonnancement optimal de 5 cibles d'implantation, réparties sur 5 années. Ces cibles ont été élaborées de façon à soutenir les priorités de l'organisation et à accélérer la récupération des bénéfices. Chacune de ces cibles permettra la mise en opération de modules fonctionnels donnant accès progressivement aux données géominières gérées par le MER.

New Brunswick Department of Natural Resources and Energy
Geoscience Program

Introduction

The New Brunswick Department of Natural Resources and Energy geoscience programs are mainly the responsibility of the Geological Surveys Branch (*see* Organization Chart) of the Mineral Resources Division. However, projects involving industrial minerals, peat, and the coastal zone are carried out by the Mineral Development Branch, while the Energy Branch has responsibility for fossil fuels and uranium. Geological Surveys Branch projects are funded via both the Provincial "A" and C-NBCAMD budgets. The latter is part of a 5-year, $10 million Canada–New Brunswick Cooperative Agreement on Mineral Development that was signed in 1990.

GEOSCIENCE PROJECTS

R.A. Wilson initiated a stratigraphic study of the Ordovician Tetagouche Group in the California Lake area, NTS 21 O/8 (Figure 1; A). Several volcanic facies were recognized and interpreted to represent subaqueous flows in the vicinity of rhyolitic domes.

M.A. Parkhill mapped the surficial geology of the northern part of NTS 21 O/8 (Figure 1; B). Most of the area is covered by a thin layer of late Wisconsinan basal till. Striations indicate that an early eastward ice movement was followed by northeastward and southeastward flow. Erratic trains indicate 30 km of glacial transport.

J. Walker and S. Gower continued bedrock mapping in the Elmtree Terrane and the adjacent Siluro–Devonian cover (Antinouri-Nicholas project: Figure 1; C). Work in 1990–91 progressed in parts of the NTS 21 O/9, 21 O/16, 21 P/12, and 21 P/13 map areas. Previously unrecognized Chaleurs Group (Silurian) sedimentary and volcanic rocks lie along the northwest edge of the Elmtree Terrane. Mineral occurrences comprise: zinc, lead, silver, and copper sulphides in Silurian and Devonian amygdaloidal flow tops; vein deposits of copper, lead, silver, and zinc sulphides (Patapat Brook); and zinc sulphide skarns within the Antinouri Lake granite aureole (Belledune Pond).

R.R. Irrinki, M.P. Rennick, and L. McNeill (Figure 1; D) assumed responsibility for a geocompilation project involving geoscience data submitted as private-sector assessment work on mineral claims in the NTS 21 O/16, 12 P/12, and 21 P/13 map areas. The project augments the Antinouri–Nicholas project outlined above. All exploration data are being digitized and entered into a CARIS-based geoscience information system (GSIS). The data are divided into a series of dBase[1] layers and converted into INGRES[2] tables. Initial results indicate several interesting target areas for base-metal and gold deposits.

W.W. Gardiner, Mineral Deposits Geologist, is also involved in the Antinouri–Nicholas project (Figure 1; E). He has identified over 240 mineral occurrences in the area covered by the project. Of these, two-thirds have been field checked. The data are being used to update the Province's computerized, mineral occurrence file and to form a basis for a new metallogenic map of the region. The occurrences are classified into the following types: vein gold; mafic-dyke gold; granite-related molybdenum-copper-fluorine; vein and breccia copper-barium; vein zinc-lead-silver sulphides; skarn copper, zinc-lead and iron-copper; ophiolite copper sulphides; mafic to ultramafic nickel-zinc-lead; and a miscellaneous base-metalgold group.

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[1] dBase IIIplus and dBasae IV are registered trademarks of Ashton-Tate.

[2] INGRES is a registered trademark of Ingres Corporation.

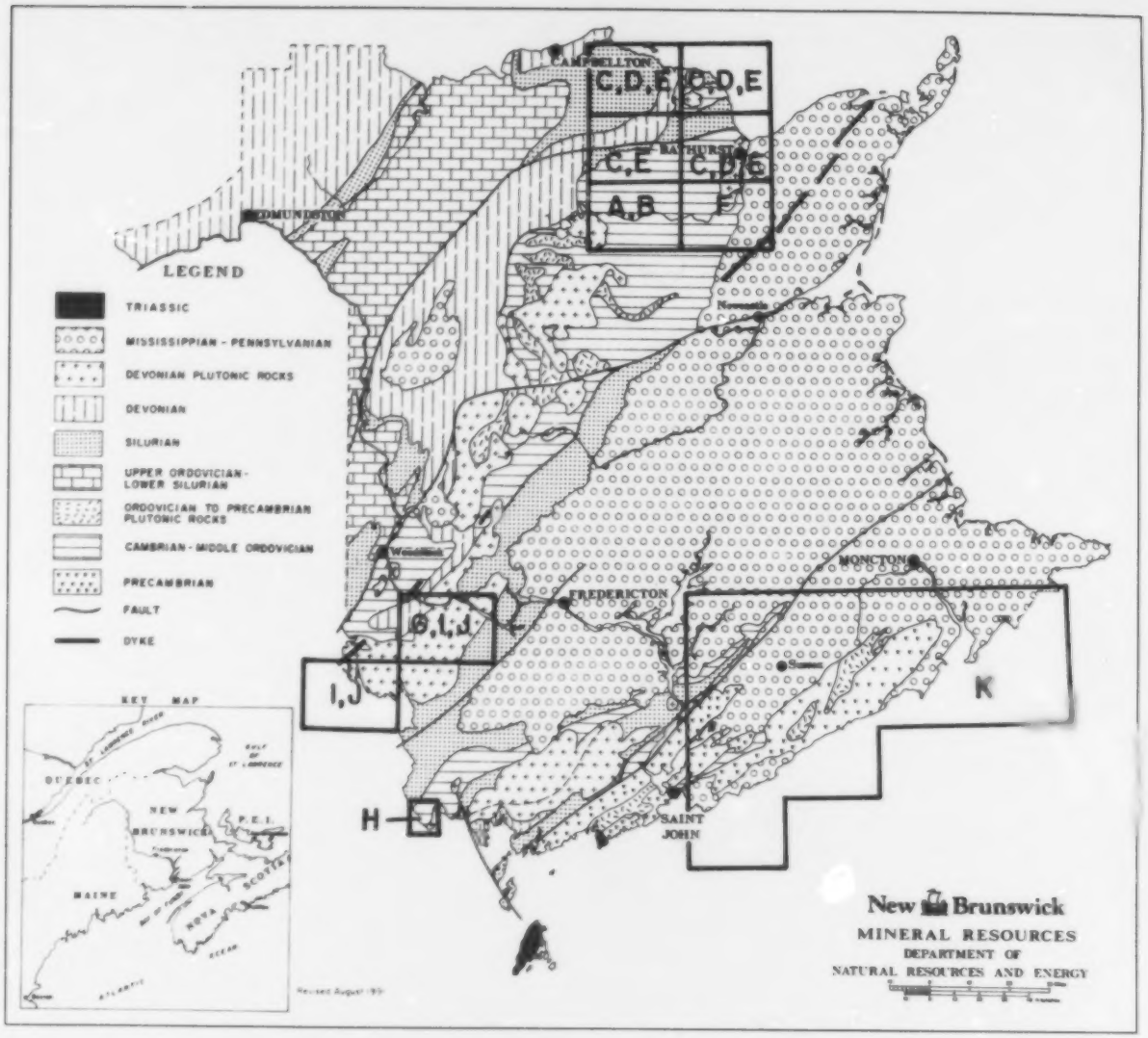

Figure 1. Geoscience program in New Brunswick.

A.Geological mapping, NTS 21 O/8
B.Surficial mapping, NTS 21 O/8
C.Antinouri–Nicholas project, NTS 21 O/9, O/16, P/12, P/13
D.Geocompilation, NTS 21 O/16, P/12, P/13
E.Studies of mineral deposits
F.Brunswick project, NTS 21 P/5
G.Pokiok project, NTS 21 G/14
H.Geological mapping, NTS 21 G/3f
I.Surficial mapping; 21 G/12, G/14
J.Stream-silt geochemical survey
K.Geological compilation, 1:250 000, NTS 21 H

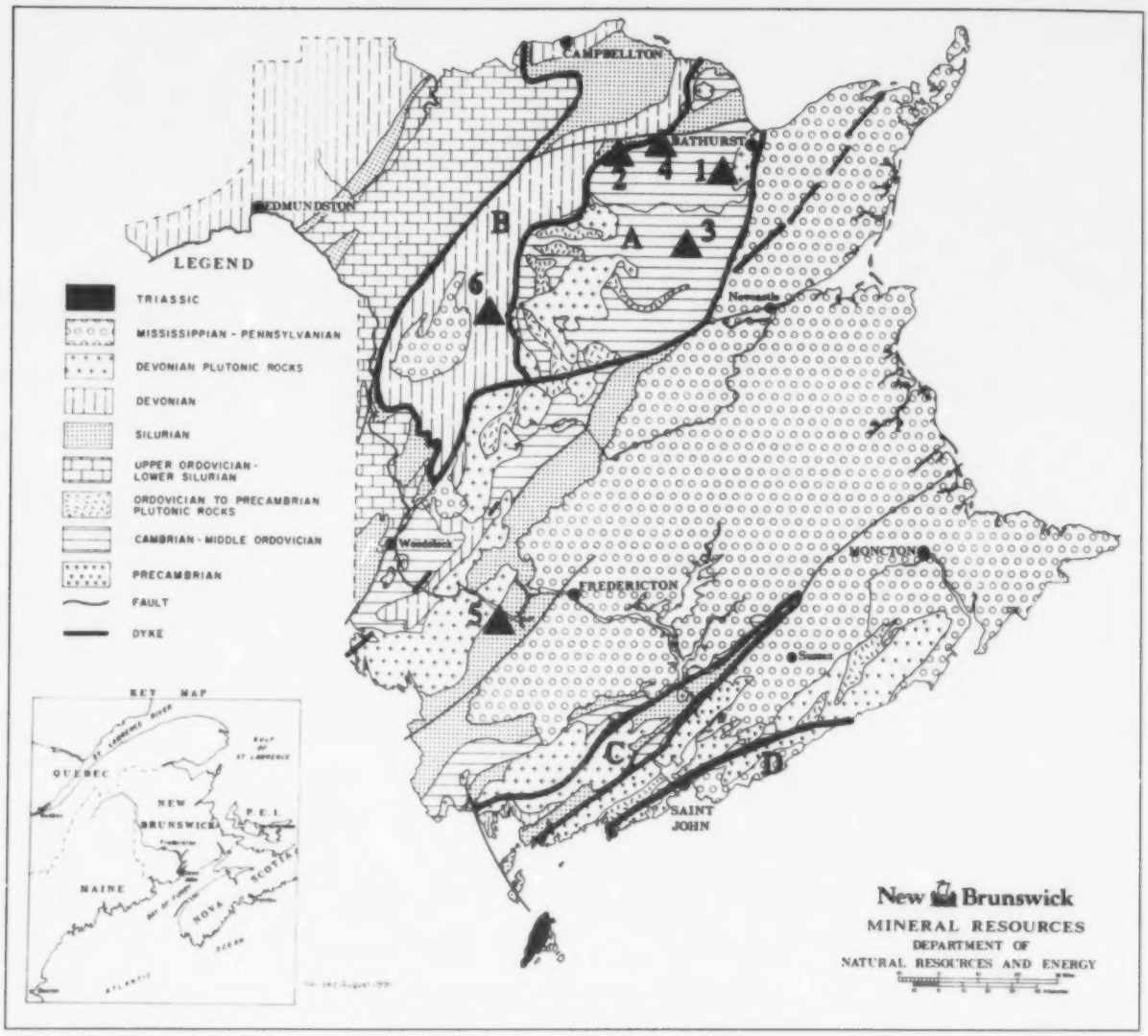

Figure 2. Mineral Exploration 1991.

A.Tetagouche volcanic complex (Bathurst–Newcastle camp)
B.Tobique–Chaleur zone
C.Annidale–Nerepis beltSt. Croix Terrane
D.Bay of Fundy gold belt
1.Brunswick No. 12 Mine
2.Murray Brook Mine
3.Heath Steele–Stratmat mines
4.Caribou Mine
5.Lake George antimony mine
6.Sewell Brook prospect

J. Langton and S.R. McCutcheon continued a detailed study of the Brunswick No.6–No.12 belt (Figure 1; F), which will help find the deeply buried zinc-lead-copper massive sulphide deposits in the Bathurst–Newcastle mining camp.

Work continued on the geological compilation of the southern part of the Province. A.A. Ruitenberg, M. McLeod, and S. Johnson were able to better delineate the extent of pre-Carboniferous terranes in the area. Of particular importance is the extension of the St. Croix Terrane (Figure 2; D), which includes gold- and base-metalbearing zones, to the northeast as far as the Carboniferous Cover.

A. Caron and A.D. Roy have recognized three types of sequentially emplaced metallic mineral veins in the Lake George antimony mine (Figure 1; G). These include stibnite-quartz, molybdenite-scheelite, and gold-bearing quartz-carbonate veins. The vein systems cut Silurian turbidites within the contact aureole of the Pokiok (Devonian) granite.

L.R. Fyffe continued his geological mapping in southwestern New Brunswick. The region is underlain by sedimentary and volcanic rocks of the Ordovician Cookson Group. The 1990–91 work involved the Potters Lake area, NTS 21 G/3f (Figure 1; H). The most interesting economic feature in the area is the St. Stephen ultramafic pluton, which hosts several lenses of Ni-Cu sulphide.

A.A. Seaman and S.A. Balzer completed surficial mapping in the Forest City (NTS 21 G/12) and Canterbury (NTS 21 G/14) map areas (Figure 1; I). The Canterbury area appears to be the site of a large ablation complex, comprising two or possibly three basal till sheets.

The surficial mapping was augmented by stream-silt sampling carried out by A.G. Pronk and his staff (Figure 1; J).

The Mineral Exploration Stimulation Program (MESP), begun in 1988 and co-ordinated by G.W. Crouse, awarded approximately $81 000 in grants to prospectors and provided funds for prospecting courses in Fredericton and Bathurst.

The Geological Surveys Branch now has three diamond-drillcore storage facilities in the Province; these contain several hundred thousand metres of core. The inventory is growing by approximately 20 000 to 25 000 m per year.

B.M.W. Carroll, assisted by S.A. Abbott, looked after the editorial needs of the Mineral Resources Division.

MINERAL EXPLORATION 1990

Early estimates indicate that $17 million was spent in mineral exploration in 1990. Respondents to a federal government survey of the industry are forecasting expenditures of $21.7 million in 1991.

During 1990, the value of New Brunswick mineral production rose 2.5% to approximately $886 million. Zinc, lead, and copper contributed 63.5% of the total. Gold production increased 100% due to opening of the Murray Brook (gossan) mine (Figure 2; 2). During the year, the Caribou zinc-lead-copper mine and the Lake George antimony mine (Figure 2; 4 and 5) were shut down.

The highlight of 1990 was an announcement by NovaGold Resources Inc. that they had discovered a base-metal deposit at Sewell Brook in Devonian volcanic rocks of the Tobique–Chaleur Zone (Figure 2; B). By late 1990, work on the Sewell Brook prospect (Figure 2; 6) included the drilling of several exploration holes. The mineralization appears to lie within a north-trending structure that is 500 m long and up to 5.7 m wide. Published grades range up to 41% zinc plus lead, and up to 130 g/t silver, over several metres.

In 1991, NovaGold signed an agreement with Kennecott Canada Inc. to carry out a detailed exploration of the deposit. NovaGold obtained the original mineral claims to investigate geological targets indicated by New Brunswick Geological Surveys Branch mapping.

In the adjacent Bathurst–Newcastle mining camp (Figure 2; A), Noranda appears to have outlined two new zinc-lead-copper sulphide deposits near the Heath Steele "C" zone (Figure 2; 3).

In southern New Brunswick, exploration continued at a somewhat reduced pace in the Annidale–Nerepis and Bay of Fundy belts (Figure 2; C and D). Base metals, gold, and platinum-group metals are the main interests in the region.

NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES GEOSCIENCE ACTIVITIES

INTRODUCTION TO THE DEPARTMENT

The Mines and Energy component of the Department of Natural Resources has a dual mandate to encourage research and development leading to enhanced documentation of mineral and energy resources and to promote their orderly regulation and use. Three divisions in the Department, Mineral Resources and Mineral Development from the Mines and Minerals Branch and Energy Resources from the Energy Branch, administer geoscience projects.

Developing and Encouraging Geoscience Activities

Nova Scotia signed the Canada-Nova Scotia Cooperation Agreement on Mineral Development in August 1990. This new agreement provides $9 million over two years (1990-1992) to encourage the economic development of the mineral industry in Nova Scotia. Of this total, $3.2 million is budgeted for the Geoscience Program. The Department will spend $1.4 million over two years supporting the provincial geoscience projects.

GEOSCIENCE ACTIVITIES

A wide variety of geoscience activities are being undertaken by the staff of the Department. These projects can be categorized as follows: 1) energy resource studies; 2) metallic and non-metallic mineral resources and deposit studies; 3) regional mapping; 4) geochemistry; 5) Quaternary research; and 6) services to industry and the public. Most of these activities are supported by the Cooperation Agreement.

Energy Resources Studies

Evaluation of the province's energy resources includes geological mapping onshore of coal, peat and oil shale deposits and monitoring offshore of private sector geological exploration for petroleum and natural gas. The Department, through the Energy Resources Division, is responsible for all petroleum and natural gas exploration monitoring and development activities onshore. It works in conjunction with the Canada-Nova Scotia Offshore Petroleum Board in administering offshore energy resources.

An offshore source rock study which was designed to highlight to areas which have most likely sourced hydrocarbons, has been completed. The report contains figures and maps which attempt to characterize the best areas for future investigations. The report will assist industry in their efforts by providing a significant new data set on the geochemical controls on hydrocarbon generation. Coalbed methane gas has long been known in the province's coal basins. The department has begun an

exxtensive inventory of coalbed methane potential in the province and will produce a data base which will include gas contents of individual coals. This information will be valuable in the future development of the untapped resource.

In the offshore realm, staff have been monitoring the progress of Canada's first offshore oil and gas project, the Cohasset-Panuke oil field development. This project will see the production of high quality oil in the spring of 1992. Ongoing review of the development plan and its components provides an opportunity to set royalties which will accrue to the province. Several studies have been undertaken which relate to the application of amplitude-versus-offset geophysical modelling for the carbonate bank which runs some 500 kilometres along the Scotian Shelf. The purposes of these studies has been to verify a new technique that will identify drillable targets. Use of geophysics in the onshore coal basins has proved to be of great value. Another study has just begun which will evaluate the hydrocarbon potential of the St. George's Bay area.

Low sulphur coal resources in the western Cumberland Basin, Stellarton Basin, and Debert-Kemptown coalfield were the subject of a continuing program of regional mapping and research on the controls of coal formation. In the Sydney coalfield, the Harbour seam is the focus of detailed sedimentological studies to define geological controls on seam thickness and on deposition of roof and floor strata. The Cooperation Agreement is funding a study of metals (major, minor and trace elements) in coal that will generate primary data about Nova Scotia coals, as well as a comprehensive computer database on Nova Scotia coal basins.

Mineral Resources and Deposits Studies

Both metallic and non-metallic mineral deposits are being investigated to increase the knowledge and understanding of the mineral potential of Nova Scotia.

Studies of metallic mineral deposits began during the 1990 summer to document the Tangier gold deposit, the Gays River lead-zinc deposit and the tin and base-metal deposits in southwestern Nova Scotia and western Cape Breton. Carboniferous sediment hosted, copper-silver and iron occurrences and deposits in northern Nova Scotia continue to be studied for their uniqueness and mineral potential. Reports will be published in early 1992.

Diamond drilling in the Murchyville, Halifax County area by the Mineral Development Division has encountered a gypsum resource in excess of 60 million tonnes. Additional areas identified by the Gypsum/Anhydrite Resources project (1985-1989) will be drilled in the near future.

Work on describing the occurrences and mineral potential of limestone, dolomite, silica, barite, andalusite, mica and garnet continues.

Bedrock aggregate potential was investigated during the 1991 field season in two a reas of the province. In the Halifax-Dartmouth area regional mapping and sampling of the bedrock continued. In the Cobequid Highlands near Amherst, a drilling program is being conducted to identify rock types suitable for crushed stone aggregate.

Regional Mapping

During the terms of the Cooperation Agreement, the major regional mapping project is in the Cape Breton Highlands. The recent interest in gold and base metals in the Highlands has generated considerable exploration activity. In an effort to understand the geological context of these mineral occurrences and deposits, the project had concurrent bedrock and surficial mapping components This mapping was supplemented by mapping in an adjacent area by the Geological Survey of Canada. This work will build on the previous mapping and mineral investigations in the Highlands developed under the auspices of the Canada-Nova Scotia Mineral Development Agreement (1984-1989).

Quaternary Studies

Compilation of a thematic Quaternary geological map was started in the spring of 1987. The map will be published in 1992. Regional Quaternary mapping of Cape Breton Island by the Geological Survey of Canada and the Department at scales of 1:50 000 and 1:25 000 is complete. In Cape Breton the glacial and residual material is being mapped and investigations on debris avalanche distribution and age are continuing.

Geochemistry

The follow-up geochemistry project is designed to document the geochemical "signature" of selected mineral deposits. Glacial till, soil, stream sediment and vegetation samples were systematically collected to describe the geochemical characteristics of selected deposits. Canfield Creek Cu-Ag, Yava Pb-Zn-Ag, Brazil Lake Li-Be, and Dominique Sn deposits were sampled. The Yava report was released in November 1991.

Service to Industry and the Public

The Department maintains a regional office at Stellarton with a library, core storage facilities and core library. Over 500 000 m of core from industry and department drilling programs are stored here. Facilities are available at the Core Library for core study and sampling. Private sector exploration activities are monitored from this office.

Large databases including GEOSCAN are available for use. The information is covered by a national geological bibliographic database. Additional databases on mineral occurrences, drillhole information and geological/geophysical maps are also available.

The Integrated Land Use Project provides information needed to formulate policy ensuring the protection, conservation and proper management of energy and mineral resources. Mineral Resource Land Use (MRLU) maps are now available for most of Nova Scotia.

The Education and Public Awareness Program promotes an understanding of the mineral resources and potential, geology and mineral industry in Nova Scotia. It is an essential part of the Cooperation Agreement and describes and promotes the programs and projects of the Agreement. Prospecting courses, displays, seminars, interpretive walks, publications, and educational materials for schools are part of the program.

CONCLUSION

The geoscience projects described here support and encourage mineral exploration and strengthen the province's mineral industry through the Canada-Nova Scotia Cooperation Agreement on Mineral Development. The steady production of industrial minerals, coal, aggregates, base metals, and tin provides a stable and diversified mineral industry. The strong mineral industry coupled with a variety of geological environments makes Nova Scotia an attractive location for mineral exploration and development.

NEWFOUNDLAND AND LABRADOR
DEPARTMENT OF MINES AND ENERGY
GEOLOGICAL SURVEY BRANCH

Introduction

The geoscientific programs of the Geological Survey Branch of the Newfoundland Department of Mines and Energy in 1991 included bedrock geological mapping, geochemical and geophysical surveys, mineral deposit studies, Quaternary mapping, and information services. The program was more extensive than that carried out in 1990, reflecting increased funding associated with the Canada–Newfoundland Cooperation Agreement on Mineral Development, which was signed in October, 1990.

Geological Mapping Program

The Branch's bedrock mapping program has the long-term objective of complete coverage of the island of Newfoundland at 1:50,000 scale, and of Labrador at 1:100,000 scale. This program, which has been underway since 1972, is slightly more than 50% complete.

Six mapping projects were active on the island of Newfoundland in 1991. Ian Knight continued his mapping of the Cambro–Ordovician carbonates in the Bay of Islands area on the west coast. This mapping has shown the structure of the area to be extremely complex as a result of folding and thrusting of the carbonate sequence through several deformational episodes. Despite extreme deformation, and the production of mylonites at thrust contacts, internal stratigraphy of the thrust sheets can be recognized and fitted into the general stratigraphic framework developed in previous work on the carbonate sequence to the north. Knight also conducted detailed mapping of a marble deposit west of Deer Lake, and assisted with a course, for petroleum industry geologists, conducted at the Centre for Earth Resources Research at Memorial University. Doug Boyce provided paleontological control for Knight's mapping, locating numerous new fossil localities in an area that previously was poorly controlled biostratigraphically. Doug also provided paleontological assistance as required in other mapping projects.

Brian O'Brien continued his analysis of structure and stratigraphy in Notre Dame Bay, concentrating on the relations between ophiolite complexes and Caradoc–Ashgill sedimentary sequences in the New Bay area, and between the Notre Dame and Exploits subzones along the Red Indian Line in the Bay of Exploits. The Caradoc–Ashgill sedimentary sequences were shown to unconformably overlie the ophiolites. The Red Indian Line has a long history, with early affects on the pre-Caradoc rocks of the Notre Dame subzone, and a later history of northwestward overthrusting that affects Ashgill rocks of the Exploits subzone to the south. The Dunnage mélange is in a separate thrust slice from the other Exploits Subzone rocks; previous reports of gradational relationships with surrounding rocks were not confirmed. O'Brien's work on the structure and stratigraphy of the area was assisted by detailed sedimentological studies carried out by Thomas Dec.

Two projects were continued in the Gander–Avalon Zone boundary area. Pat O'Neill completed 1:50,000 scale mapping of the Gander zone portions of NTS 2D/9 and 2D/10, while Sean O'Brien completed the eastern part of NTS 2D/9, which lies in the Avalon Zone. O'Brien and O'Neill, together with Bob Holdsworth of the University of Durham, England, jointly examined the polyphase deformation along the Dover Fault at the contact of the Avalon and Gander Zones. Sean O'Brien, assisted by Cyril O'Driscoll, also re-examined contacts in Avalon Zone rocks in the Hermitage Bay area, in the light of new geochronology by Bob Tucker from the Royal Ontario Museum; their work identified an erosional unconformity separating the Furby's Cove Granite (ca. 670 Ma) from overlying sedimentary and volcanic rocks (ca. 620 Ma). Sean and Brian O'Brien, again following up geochronology by Bob Tucker, also conducted detailed mapping in the La Poile area of the south coast. The work there identified three different structural belts, two of which are intruded by 477 million-year-old granite, indicating that these

rocks are somewhat older than previously envisaged. One of these belts contains a highly strained trail of ophiolite fragments, and has recently been staked by industry as a new exploration target.

Lawson Dickson mapped the Great Bend ophiolite complex and surrounding rocks in central Newfoundland, completing the western half of NTS 2D/11. Various elements of the ophiolite stratigraphy have been identified, and a possible dynamothermal amphibolite aureole delineated. At least three sedimentary sequences separated by unconformities have been recognized in the rocks overlying the ophiolite. The southern end of the Mount Peyton Intrusive Suite was also mapped.

Andy Kerr initiated a project to compile a data base on the geochemistry of intrusive rocks in Newfoundland. The computerized, data base file on granite was reviewed and revised, and part of the field season was devoted to sampling of intrusions presently underrepresented in the data base.

Four mapping projects were carried out in Labrador. A new project was initiated in the extreme north, under the direction of Dick Wardle. This project, to be carried out in co-operation with the Geological Survey of Canada (GSC), has the long-term objective of mapping the Torngat Mountain chain north of 5930'. This area covers the boundary between the Archean Nain craton and the Lower Proterozoic mobile belt of the eastern Churchill Province, and includes an enigmatic crustal block referred to as the Burwell Terrane. This terrane has been varyingly interpreted as a detached portion of the Nain craton and as an independent Proterozoic plate. This summer's work has confirmed the projected extent of Nain Province rocks in the area, but indicates the Burwell Terrane to be dominated by tonalitic and charnokitic plutons of probable Proterozoic age. The boundary between these rocks and Nain Province is primarily intrusive, locally modified by ultramylonite shear belts. The discovery of this intrusive suite, which appears to indicate a relict, magmatic arc terrane along the western edge of the Nain craton, requires re-examination of existing tectonic models and raises new possibilities for mineralization environments in northernmost Labrador. Nain Province rocks in the area are dominated by granitoid gneisses intruded by a linear anorthosite pluton of Archean age. This pluton is considerably larger than indicated on previous maps and appears to represent the deformed remnants of a layered intrusion. It contains several prominent sulphide-enriched horizons that are being investigated for their nickel and platinum group element (PGE) potential.

Systematic 1:100,000 scale mapping of the Archean Superior Province in western Labrador was carried out under the direction of Don James. This project represents a southward continuation of recent mapping by the GSC in NTS 23J. The area is underlain by metamorphosed supracrustal rocks, metatonalite, granitoid migmatite, and orthopyroxene-bearing granodiorite. All units are metamorphosed to granulite facies and deformed by at least two phases of folding. The supracrustal rocks have some potential for hosting gold deposits.

Bruce Ryan continued a mapping project designed to compile and, where necessary, re-interpret the Nain Plutonic Suite (NPS). The NPS is perhaps the type example of a mid-Proterozoic anorthosite-granite intrusion and has been considered typical of the so-called anorogenic plutons of the Elsonian magmatic event. The perception of the NPS as a pristine, undeformed massif began to break down in 1990, when reconnaissance work discovered the presence of large areas of strongly deformed to gneissic anorthosite and related granitoid rocks. Field work in 1991 concentrated on further definition of the extent of deformed anorthosite and on collection of samples for geochronology.

In 1991, field work resumed on the Eastern Grenville project, which has been in the report preparation phase for the past two years. Tim van Nostrand led a party which carried out systematic mapping in the Alexis River area, in the northwest quarter of map sheet NTS 13A. The eastern half of the map area is underlain by several narrow belts of variably deformed rocks (granitic and metasedimentary gneisses). These belts occur within and adjacent to the Gilbert River shear zone and are characterized by northwest-trending fabrics. They are probably Labradorian (1710–1620 Ma) in age. The southeastern part of the map area is dominated by megacrystic granodiorite-granite and sillimanite-bearing metasedimentary gneiss, with large intrusions of variably deformed granodiorite granite and diorite. Several gossan zones were found in association with metasedimentary gneiss.

Geochemistry and Geophysics Program

The Geochemistry–Geophysics Section is responsible for geochemical and geophysical surveys, geochemical data base management, and the geochemical laboratory.

Analysis of archived lake sediments, for gold and related elements, continued in 1991 under the general direction of Peter Davenport. This project will be completed for all of the island of Newfoundland in 1991, with results being released early in 1992. The project has led to considerable new staking over the past three years.

Field geochemical surveys were carried out in northern Labrador, where John McConnell led an investigation of areas which had shown anomalous gold and base metal values in regional lake sediment and stream surveys. Work consisted primarily of detailed stream sediment sampling; water, panned concentrates and rock samples were also collected. Three new areas of base metal mineralization were identified during the course of the work.

Gerry Kilfoil, the Branch's geophysicist, continued his assessment and treatment of available digital geophysical data. This work included: the correction, levelling, gridding and filtering of aeromagnetic data from Labrador; filtering of gamma-ray data from insular Newfoundland; and a review of all geophysical surveys listed in our files, with the objective of adding data of acceptable quality to the growing digital geophysical data base for the province. The Branch will acquire a new E-size, colour raster plotter early in 1992, to permit production of colour maps from the digital data bases.

The data base management project, led by Jim Butler, is currently aimed at the collection, verification and documentation of geochemical data sets (stream and lake sediment, soil, till, and rock) from government surveys in the province, to provide this data in readily usable digital form to users inside and outside the department. This project will be extended to encompass geophysical and geological data in digital form.

The geochemical laboratory, under the direction of Hank Wagenbauer, provides high quality analysis of geological materials. The laboratory this year initiated purchase of a new inductively coupled plasma optical emission (ICP-OE) spectrometer, which will allow expansion of the suite of elements which can be analyzed in-house, as well as permit increased detection limits. Delivery of the new instrument is expected early in 1992.

Mineral Deposits Program

The Mineral Deposits Section is responsible for metallogenic studies, industrial mineral assessments, and mineral deposit inventory.

Three metallogenic projects were active in the field in 1991. Dave Evans continued work on gold deposits in central Newfoundland, concentrating this year on the central part of the project area, south of Gander Lake. Individual showings in this area vary considerably in host rock lithology but exhibit similar styles of structural control and are interpreted to be dominantly mesothermal in nature. This project also supported an M.Sc. study of the Duder Lake occurrence in the northeastern part of the project area. Field work and logging of drill core was carried out on this occurrence this year.

Randy Miller continued his study of the high-technology metal (e.g., Zr, Y, Nb, Be and REEs) potential of peralkaline rocks in the province. Field work in Newfoundland consisted of a detailed follow-up study of interesting areas identified during the 1990 program in the Kings Point Complex near Springdale and new studies in the Topsails, Sheffield Lake and Grand Lake areas. Results of radiometric studies suggest some potential for rare metal enrichment in peralkaline flows in the Kings Point and Grand Lake areas; further assessment awaits analyses of rock samples. Work in Labrador concentrated on the Flowers River area, mapping the volcanic-intrusive complex there in detail and investigating the setting of rare metal mineralization in the area. Certain ignimbritic flows of the volcanic suite are highly

radioactive and have a high potential for rare metal occurrences. Radioactive aplite veins occur locally and also may be metal enriched.

Two office-based metallogenic projects were also carried out in 1991. Scott Swinden, Senior Geologist for the Mineral Deposits Section, directed a number of compilation projects related to assessment of regional metallogeny in Newfoundland and Labrador. These included a summary of the mineral potential of Labrador, which was published in March, and compilation and editing of the metallogeny chapter of the DNAG Appalachian volume. Work continued on the mineral deposits map of Newfoundland, and on a map showing the relationships of major lineaments to base and precious metal deposits. Cindy Saunders began work, early in 1991, on compilation of a data base of volcanic rock geochemistry. Emphasis will initially be on geochemistry of volcanic rocks related to Cambro–Ordovician massive sulphides in central Newfoundland.

Two industrial mineral assessment projects were carried out in 1991. The first, under the leadership of Ambrose Howse, concentrated on the industrial mineral potential of the Carboniferous basins in western Newfoundland. Field work was carried out in the southern part of the St. George basin, looking at the geological setting of gypsum, salt and carbonate deposits. As well, an investigation was conducted into metamorphic mineral occurrences (garnet, muscovite, refractory minerals) in the basement rocks to the south and east of the basin.

The second industrial mineral assessment project, under Jamie Meyer, concentrated on heavy mineral sands and dimension stone in Labrador. A field investigation of heavy mineral sands in the Porcupine Strand area of Labrador was conducted in co-operation with C-CORE and Cominco Ltd. Studies were aimed at defining the size and mineralogy of the resource, and at determining concentration processes and the response of the deposits to geophysical techniques. Work continued in the Nain area of northern Labrador on the development of anorthosite as a dimension stone.

In the mineral inventory project, work continued on documentation of mineral occurrences in Labrador and updating of mineral occurrence maps in Newfoundland. The mineral occurrence map for Lac Virot (parts of NTS 23G and 23B) was published. As well, an industrial minerals map for the island of Newfoundland, at a scale of 1:1 000 000, was published. A major milestone in the project was reached with the production of a microcomputer version of the Mineral Occurrence Data System (MODS-PC). The system is scheduled for release in the fall of 1991.

Terrain Sciences Program

The Terrain Sciences Section continued its surficial mapping and aggregate assessment projects in Newfoundland, initiated a new mapping project in Labrador, and began a new urban geology project in the greater St. John's area.

Dan Bragg extended his mapping of bedrock aggregate sites to the Great Northern Peninsula, in a search for new sources for domestic construction and export. He also provided consultation, sampling and interpretation for large aggregate deposits at Lower Cove, on the Port au Port Peninsula; and continued his evaluation of the bedrock aggregate resources of the Great Mosquito Cove area of Bull Arm, where the offshore concrete production platform for the Hibernia oilfield is being constructed. Dan is also involved with CANMET and highway engineers, evaluating the extent of alkali reactivity damage to bridges in the province.

Jerry Ricketts continued his regional granular aggregate survey in central Newfoundland, moving into the Grand Falls area. This project determines the location, quantity and quality of sand and gravel deposits, utilizing field studies as well as petrography, abrasion, soundness and alkali reactivity testing.

Martin Batterson resumed surficial mapping in the Humber River area of western Newfoundland, taking advantage of the new sections opened up by major construction along the Trans–Canada highway. Results of this mapping include the discovery of an early, topographically controlled glacial advance

from the north followed by a stronger westward advance across the area from the Topsails Hills. During the late stages of glaciation, a major glacial lake formed in the Humber basin. A postglacial marine event deposited sediment to 50 metres above present sea level, with major implications for mineral exploration and geotechnical applications in the area.

David Liverman began a surficial mapping project in the Labrador Trough near Schefferville, in support of drift prospecting. Initial findings indicate a complex ice-flow history with up to four directions preserved in single outcrops. There is also abundant evidence that glacial meltwater played a substantial role in distributing surface sediment.

Dave Proudfoot, working with Ali Aksu of Memorial University, correlated the surficial geology of the Daniel's Harbour to Port aux Choix area of the west coast with seismic interpretation of adjacent submarine surficial sediments. Results of the correlation include the location of major ice margins of Labrador and Newfoundland ice sheets off the coast, with a probable coalescence to the north. Proudfoot also initiated a new urban geology project in the greater St. John's area. It is designed to compile existing data and collect new data in undeveloped areas, to meet the growing demands of geotechnical engineers and land-use planners.

Lloyd St. Croix and Dave Taylor continued their island-wide striation reconnaissance program, concentrating this year in west-central Newfoundland. Five 1:50,000 scale map sheets were surveyed, adding 500 new striation sites to the provincial data base. Four separate ice flow events were recorded, confirming the significance of Newfoundland-based ice in late glacial time. All provincially collected striation data are now available in digital form.

Geoservices Program

The Geoservices Section consists of Publications, Cartography, Industry Services, Geoscan, and Public Information.

The publications unit, under the direction of scientific editor Christopher Pereira, published six geoscientific reports since September, 1990, including the Current Research volume (Report 91–1) for a total of 963 typeset pages. Other reports include the summary Report of Activities, 20 open-file reports, user manuals and indexes.

The cartographic unit, led by Ken Byrne, produced three full-colour maps, including Geology of the St. John's Area. Eleven 2- or 3-colour mineral occurrence and geological maps were published, and 244 open-file "blueline" maps were released in the geochemistry and surficial geology series.

Industry Services, under the direction of Norm Mercer, is responsible for approximately 10,000 geoscientific documents, a technical library, and industry requests for information and advice. Some 800 company orders for maps and reports were filled during the report period.

The third in a series of GEOSCAN NTS indexes were published in December, 1990. It covers assessment reports for the period July, 1989 through June, 1990. Cathy Patey is project geologist for the GEOSCAN project.

Baxter Kean was hired as public information geologist, in April, 1991, to promote the province's mineral potential to industry and to explain geoscience and mining to students and the general public. Displays, guidebooks, posters and media kits are in preparation.

INDIAN AND NORTHERN AFFAIRS CANADA
NWT GEOLOGY DIVISION

Federal government budget tightening continued to reduce the level of activities of the NWT Geology Division. Only two NWT Geology Division mapping crews operated in 1991. V.A. Jackson and a crew of seven mapped approximately three 15 by 30 minute guadrangles along the northwest edge of the Slave Province northeast of Kikerk (Takijuq) lake. This work will continue over the next few years as the NWT Geology Divisions's contribution to the Slave Province NATMAP effort. It will complete mapping at 1:50,000 scale of the northwestern part of the Slave Province. This work was coordinated with 1:20,000 scale mapping in the Amooga-Booga Lake area (86 I/2) by a MIO crew under J. Gebert.

J.A. Brophy, assisted by various NWT Geology Division staff, mapped and sampled the Wheeler Lake turbidite domain which contains an abundance of auriferous iron formation. Structural, geochemical and stratigraphic studies are underway to unravel the setting and genesis of these gold showings. This work will be coordinated with a broader-scale project to study iron-formation-hosted gold deposits of the NWT under a joint Geological Survey of Canada (MIP)-NWT Geology Division project.

Detailed stratigraphic analysis was undertaken by W.A. Padgham (assisted by numerous others) of the Requette Lake Formation on the east side of the Yellowknife Supracrustal Basin to settle an ongoing controversy over the relationship of that formation to the cameron River and Beaulieu River volcanic belts. The latter is the site of numerous silver-rich volcanogenic massive sulphide deposits.

In the Yellowknife volcanic belt, contract mapping was begun by Ms. K. MacLachlan, a student of H. Helmstaedt at Queen's University. Ms. MacLachlan and an assistant began detailed mapping of the multiple dyke complex near the base of the Kam Group, host to Yellowknife gold deposits. S.A. Bowring (Massachusetts Institute of Technology) and various staff from Australian National University and MIT continued contract mapping around the site of the oldest rocks in the world on the Acasta River (NTS 86 G/2 and 7). Numerous geochronology samples were collected in the Yellowknife Basin as part of a joint MIT/NWT Geology Division project to improve our knowledge of the structure and tectonics of this gold-rich basin. A contract was let to A. Aspler to study volcanogenic hot-spring-related gold deposition associated with volcanism in the proterozoic rocks overlying the Rankin-Ennadai volcanic belt of the Keewatin. D. Kerr, also under contract, completed surficial mapping in the Hepburn Island map area (76 M) and produced a 1:250,000 compilation thereof.

S. Schaan and one assistant mapped parts of NTS area 75 M/5 to determine the extent (if any) of Beniah Lake Formation stable-shelf sediments (quartz arenties) and to improve knowledge of this area last studied during reconnaissance canoe work in the 1940s. This work was supervised by Prof. W.K. Fyson of Ottawa University, who also provided advice and assistance to a number of other NWT Geology Division and MIO projects. Schaan's work will complement a MIO project to map the whole of the Camsell River supracrustal belt at 1:50,000.

The first Canada-NMW mineral development agreement (MDA) was successfully completed (March 31, 1991) and a new agreement titled The Mineral Initiatives Program was entered into under the general Canada-NWT Economic Development Agreement. Although the new agreement did not receive final approval until August many projects were begun with bridge funding provided by the Geological Survey of Canada and the Government of the NWT. Details of the projects have been provided by the Canada-NWT. Mineral Initiatives office (below).

Results of most of the projects conducted by NWT Geology Division staff, by Mineral Initiative Office Staff and by the Geological Survey of Canada under the Mineral Initiatives Program were reported in the Exploration Overview 1991 and presented at the 19th annual Geoscience Forum, held in Yellowknife during the last week of November, 1991.

Public releases during 1990 included 22 open files, an overview of exploration, mining and geological activities for 1990, a preview for 1991, and various articles and abstracts submitted for external publication. A mineral Industry Report giving details of property exploration in the NWT in the years 1986 and 1987 was published in November 1991.

INDIAN AND NORTHERN AFFAIRS CANADA
EXPLORATION AND GEOLOGICAL SERVICES DIVISION YUKON

Exploration and Geological Services Division (EGSD) is part of the Mineral Resources Directorate of the Northern Affairs Program, one of five programs of Indian and Northern Affairs Canada. The division, consisting of 5 geologists, one geotechnician, an office manager, and a map sales manager, is responsible for mineral resources management in the same way as any provincial department of mines.

As part of its mandate, EGSD produces an annual review of mineral exploration. "Yukon Exploration" has a new format. The new format allows more detailed descriptions of exploration and development projects visited by EGSD staff as well as a review of staff activities and synopsis of the Yukon mineral activities in general. The results of assessment work are complied in the "Yukon Minfile". Archer Cathro's Northern Cordilleran Mineral Inventory was purchased through the Economic Development program and recently complied into a computer database similar to the B.C. Minfile. Exploration and Geological Services Division wishes to thank the British Columbia Geological Survey, in particular Ron Smyth and Gib McArthur, for their support and cooperation in providing Minfile software for Yukon's development of a digital mineral inventory. The database is annually updated and will soon be available on computer disk format. The "Yukon Geology" series is a vehicle for publishing the results of geological research on a variety of topics. Geological maps at a scale of 1:50 000 are available in Open File format in certain areas of interest to the mining industry. A complete publications list is available from the Canada Map Office, Indian and Northern Affairs Canada, 200 Range Road, Whitehorse, Yukon, Y1A 3V1.

The projects described below were funded either by EGSD, or through the Canada-Yukon Economic Development Program (EDP)

GEOLOGY DIVISION PROJECTS - 1990

S.R. Morison – Chief Geologist

Responsible for supervising and co-ordinating the activities of the Geology Section and representing the Mineral Resources Directorate on several national and local committees. Assisted with the planning of Economic Development programs including the current Mineral Resources Subagreement. Chaired the committee which planned and organized the 18th Annual Geoscience Forum. Visited several active placer operations in the Dawson Region.

Grant Abbott – Minerals Geologist

Mainly responsible for 1:50 000 mapping projects, and this year worked in the Selwyn Basin near MacMillan Pass and in the Patterson Range. Was co-leader along with R. Turner of the IAGOD field trip to mineral deposits of the Northern Canadian Cordillera, Yukon - N.W. British Columbia, and co-edited the accompanying guidebook.

Trevor Bremner – Staff Geologist

Assisted in the design and update of Yukon Minfile. Co-ordinated the compilation and dispersion of exploration and development data collected by staff geologists. Visited mining properties for documentation in Yukon Exploration 1990.

Dennis Ouellette – Staff Geologist

Approved, catalogued and indexed assessment reports from the Watson Lake and Whitehorse Mining Divisions. Visited active exploration projects in the Whitehorse and Watson Lake Mining Divisions.

Bill LeBarge – Staff Geologist

Approved, catalogued and indexed assessment reports from the Mayo and Dawson Mining Divisions and all Yukon placer reports. Directed operations of the H.S. Bostock Core Library. Field work included visiting several actively explored mining properties in the Dawson District and collecting geotechnical information and samples from placer operations in the Dawson area.

AFFILIATED PROJECTS

Brent Alloway (PhD) University of Toronto – Study of Tephra Age and Stratigraphy in Klondike Area Alluvial Sediments.

Ken Ridgway, University of Rochester – PhD study of the Relationship of Denali Strike-Slip Movements to the Stratigraphy of the Amphitheatre Formation.

Tim Liverton, University of London – PhD study of Igneous Intrusions in the Englishman's Range.

Mike Spicuzza, Southern Methodist University, Dallas, Texas – PhD study of the Metamorphism of the Quiet Lake Batholith.

RECENT PUBLICATIONS

Reports Released:

- EGSD Open File 1990-1 "Geology of Mt. Westman (106 D/1) Map Area" by J.G. Abbott, EGSD and the GSC
- EGSD Open File 1990-2 "Geological Map of the Tiny Island Lakes Map Area (105 M/16)" by S. Gordey, GSC
- EGSD Open File 1990-3 "Geology of 106 D/8 and 106 D/7 (east half) Map Areas" by C. Roots, GSC
- EGSD Bulletin 2, Geology and Genesis of the Mount Skukum Epithermal Gold-Silver Deposits, Southwestern Yukon Territory, (NTS 105 D/3,6) by B.D.W. McDonald

FIELD WORK IN 1990

- Lansing Range 105 N
- Niddery Lake 105 O

CANADA-YUKON ECONOMIC DEVELOPMENT PROGRAM

MINERAL RESOURCES SUBAGREEMENT

Economic Development Agreement Extension

Geological Mapping and Related Studies

- Open File 1990-4 "Geology of Whitehorse, Alligator Lake , Fenwick Creek and Part of Robinson Map Areas (105 D/2, 3, 6, 7 & 11)" by C.J.R. Hart and J.K. Radloff: replaces Open Files 1988-2, 1989-1 and 1989-2.

Economic Development Program

Regional Stream Sediment and Water Geochemical Surveys

- G.S.C. Open File 2173 NTS map sheet 105 J
- G.S.C. Open File 2174 NTS map sheet 105 K
- G.S.C. Open File 2175 NTS map sheet 105 D, Part of 106 C,106 E and 106 F
- G.S.C. Open File 2176 NTS map sheet 116 A, 116 H, southern half

GEOLOGICAL PUBLICATIONS

During the March 1989 meeting of the Provincial Geologists it was decided that the listing of provincial and territorial geological publications would no longer be included in this Journal. A list of publications may be obtained from the National Geoscience Centre in Ottawa. For more information, contact David Reade, Geoscan Centre, Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario Canada K1A 0E8 (613)992-9550.

ARTICLES

FEDERAL/PROVINCIAL MINERAL DEVELOPMENT AGREEMENTS (1990 and later)

Province/ Territory	Amount of agreement millions $	Cost sharing formula	Period	Programs	Budget ($ x 10^3)	Sharing formula % Can./Prov.
British Columbia*	10	50/50	1991-95	Geoscience	5000	44/56
				Technology	2850	63/37
				Economic Development	950	37/63
				Public Information	550	45/55
				Evaluation, Administration	650	62/38
Alberta* R. Harrison 403-438-7615	10	50/50	1991-95	Geoscience	6000	42/58
				Others	4000	
Saskatchewan Bob Macdonald 306-787-2568	10	50/50	1990-95	Geoscience	7350	37/63
				Mining and Processing	1350	100/0
				Economic Development	400	75/35
				Public Information	350	64/36
				Evaluation and Administration	550	68/32
Manitoba Charlene van Engel 204-945-1872	10	50/50	1990-95	Geoscience	5500	54/46
				Technology	2000	75/25
				Economic Development	1400	28/72
				Public Information	350	71/29
				Evaluation and Administration	750	46/54
Ontario* L. Owsiacki 705-670-7288	30	50/50	1991-95	Geoscience		
				Mining & Mineral Technology		
				Information Transfer		
				Exploration Technology		
				Industrial Minerals		
Quebec	L'entente auxiliaire Canada-Québec sur le développement minéral est echue depuis le 31 Mars 1991.					
New Brunswick J.L. Davies/R. Harris 506-453-2206	10	60% Can. 40% N.B.	1990-95	Geoscience	4000	60/40
				Technology Development	3750	50/50
				Development Opportunities	500	60/40
				Public Information	500	50/50
				Evaluation & Administration	1250	58/52

*Under negotiation

FEDERAL/PROVINCIAL MINERAL DEVELOPMENT AGREEMENTS (1990 and later)
(continued)

Province/ Territory	Amount of agreement millions $	Cost sharing formula	Period	Programs	Budget ($ x 10^3)	Sharing formula % Can./Prov.
Nova Scotia D. Murray 902-424-4700	9	55% Can. 45% N.S.	1990-92	Geoscience Minerals Technology Economic Development Mineral Investment Stimulation Public Information Administration	3172 2160 1827 500 573 768	57/43 76/24 22/78 100/0 35/65 52/48
Newfoundland B. Greene 709-729-2763	17.5	70% Can. 30% Nfld.	1990-94	Geoscience Minerals Technology Economic Development Mineral Industry Assistance Public Information Administration & Evaluation	9000 3500 1000 2000 930 1070	48/52 29/71 50/50 50/50 59/41 11/89
Northwest Territories Martin Irving 403-920-3125	8.2	70% Can. 30% Terr.	1991-96	Geoscience Technology information Prospectors Assistance	7500 200 200 300	70/30
Yukon Steve Morison 403-667-3200	1.01	70% Can. 30% Yukon	1990-91	Geoscience Geochemistry Mining Research & Development Administration	3650 5500 750 200	100 100 96/4

*Under negotiation

SURVEY OF HARD ROCK DRILL CORE PROGRAMS IN CANADA
FISCAL YEAR 1990-91

Province	B.C.**	Alta.	Sask.	Man.	Ont.	Que.	N.B.	N.S.	Nfld. & Lab.	P.E.I.	Yukon	N.W.T.
No. of facilities	1	1	2	4	7	4	3	4	6	1	1	1
Staff-person days work 1990-91	10	90	126.5	175	2821	510.0	252	925	610	–	140	–
Capital cost 1990-91 ($ x 000)	5.4	nil	nil	5.0	1.0	9.0	–	–	67.0	–	62.8	4.0
Operating cost 1990-91 ($ x 000)	5.0	40.0	18.6	13.0	146.6	124.9	68.7	178.3	44.0	–	4.4	8.0
Core completed and/or delivered 1990-91 (m)	–	22 000	3 286	8 127	51 172	70 000	9 700	16 294	15 944	–	3038.56	–
Core Reduction*	nil	nil	nil	nil	887 m	nil	nil	nil	nil	–	nil	nil
Use of facilities person days (pd) 1990-91 visits (v)	15 pd	140 pd	74 pd	15 v	1 363 pd	175 pd	300 pd	367 pd	114 pd	2	60 pd	27
Total core in storage (from allyears) (m)	15 000 m	45 000 m	72 491	192 750	728 854	265 000	311 700	483 532	691 727	1 298	124499.3	35 055
Total exploration drilling 1990-91 (m)	26 967 m	2 000 m	186 865	197 000	293 046	743 455	150 000	15 000	85 000	–	30 000	188 678

*Over last year.
**Coal core is not hard rock. There are no facilities for hard rock in B.C. – figures are for coal.

1991/92 ANNUAL REVIEWS OF ACTIVITIES
PROVINCIAL AND FEDERAL GEOSCIENTIFIC ORGANIZATIONS

Provinces or Terrotiry Location	Date(s) (no. of days)	Time for talks	Universities involved?	Industry involved?	Poster session	Universities involved?	Industry involved?	Publication	Energy[1] matters	Other[2] topics	Comments
British Columbia Vancouver	29 Jan. 1992 (1 of 4)	1 day	yes	yes B.C. & Yukon Chamber Annual Meeting	yes	yes	yes	- Geological Fieldwork - B.C. Mineral Exploration Review, 1991	yes	yes	Part of "Cordilleran Geology and Exploration Roundup" 28 Jan. – GSC; DIAND-Yukon 29 Jan. BCEMPR 30-31 Ja· BC-YCM
Yukon Territory Whitehorse	24-27 Nov. 1991 (3) Whitehorse	3 days	yes	yes	yes 3 days	yes	yes	no	no	yes	Contributions from DIAND, GSC and industry. 19th Annual Yukon Geoscience Forum.
(DIAND)	28 Jan. 1992 (1 of 4) Vancouver	one 1-hour session	no	no	yes	yes	no	no	no	no	Part of "Cordilleran Geology and Exploration Roundup" with BCEMPR, BC-YCM, GSC.
Northwest Territories (DIAND)	27-29 Nov. 1991 (3)	3 days	yes	yes	concurrent	yes	yes	Exploration, Mining and Geology Overview	Coal only	as required	Organized with NWT Chamber of Mines, GSC involved. Also take part in "Cordilleran Geology and Exploration Roundup", Vancouver.
Alberta	Alternative years: scheduled fall 1992										
Saskatchewan Regina	26-27 Nov. 1991 (1.5)	0.5 day	yes	no	1 day	yes	yes	Summary of Investigations	no	no	Saskatchewan Research Council and GSC involved.
Manitoba Winninpeg	25-26 Nov. 1991 (1.5)	1.5 day	yes	yes	1.5 days	yes	yes	Rept. of Field Activities (RFA) and Prelim. maps	no	yes	Expanded Core Shack. GSC projects (3) reported in Provincial RFA.
Ontario Toronto	9-11 Dec. 1991 (2.5)	2.5 days	yes	yes	2 days	yes	no	Summary of Field Work and Report of Research	no	yes	Research oriented, Mineral Dev. Forum. OGS involved.
Quebec Quebec City	27-28 Nov. 1991 (2)	2 days	yes	yes	2 days	yes	no	Report of Activities	no	no	Special publication of talks presented.
New Brunswick Fredericton	4-5 Nov. 1991 (1.5)	1.5 days	yes	no	1.5 days	yes	no	1991 Project Resumes	yes	yes	GSC involved. Workshop on "Computer Applications in the Mineral Industry"
Nova Scotia Halifax	21-22 Nov. 1991 (1.5)	1.5 days	no	no	1.5 days	yes	no	Program and Summaries	yes	yes	GSC involved
Newfoundland St John's	7-8 Nov. 1991 (1)	0.5 day	yes	no	1 day	yes	yes	yes	yes	yes	GSC involved
Prince Edward Island Charlottetown	No review of activities scheduled for 1991-92										
Geological Survey Canada - Ottawa	20-22 Jan. 1992 (2)	1.5 days	no	no	concurrent	yes	yes	Abstract Volume	yes	yes	

1 Energy Matters (e.g. oil, gas, coal, oil shales, peat).
2 Other Topics (e.g. administration, engineering, regulations, legislation, etc.)

DISCOVERY METHODS FOR CANADIAN METAL MINES THAT OPENED IN 1990

Province: Ontario

Mine:	Kerr Mine	Langmuir no. 1 Mine
Discovery:	Old	Old
Date of discovery: (Reassessment)	1906 (Mine opened 1938) Reactivated 1990	1965 (1990)
Discovery Technique:	Prospecting	Geophysics
Reserves:	2 Million tons @ 0.13 opt	187 000 tons @ 1.86% nickel
1990 Production:	10 726 ounces	1260 tons of development ore @ 1.83% nickel
Mining Type:	Underground	Underground
Milling Rate:	800 tons/day	500 tons/day
Commodities:	Au	Ni
Deposit Classification:	Vein	Massive nickel sulphide

Province: Yukon

Mine:	Vangorda	Sa Dena Hess (Mt. Hundere)
Discovery:	Old	Old
Date of discovery: (Reassessment)	1953 -	1962 -
NTS:	105K/06	105A/10
Location:	Anvil District Faro, Yukon	54km north of Watson Lake
Methods of discovery: (Reassessment)	Prospecting/ Diamond Drilling	Prospecting/Trenching/ Diamond Drilling
Reserves:	7 100 000 tonnes 3.4% Pb, 4.3% Zn, 48 gpt Ag	3 939 000 tonnes 4.1% Pb, 12.8% Zn, 59 gpt Ag
Mining Type:	Open Pit	Underground
Commodities:	Pb, Zn, Ag	Pb, Zn, Ag
Deposit Classification:	Stratabound Concordant	Skarn
Key Reference:	MINFILE #105K 61	105A 12

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